the OIL AND GAS JOURNAL

JUNE 18, 1956

Featuring . . .

New Engineering Technology on . . .

TEXAS-LOUISIANA

Plus . . .

Special Oil-Activities Insert Map

Court Order Freezes Drilling Off Louisiana

"This is going to put some people out of business" some operators predict. p. 136

New Texas Discovery Boosts B.A.'s Stock as Top Wildcatter

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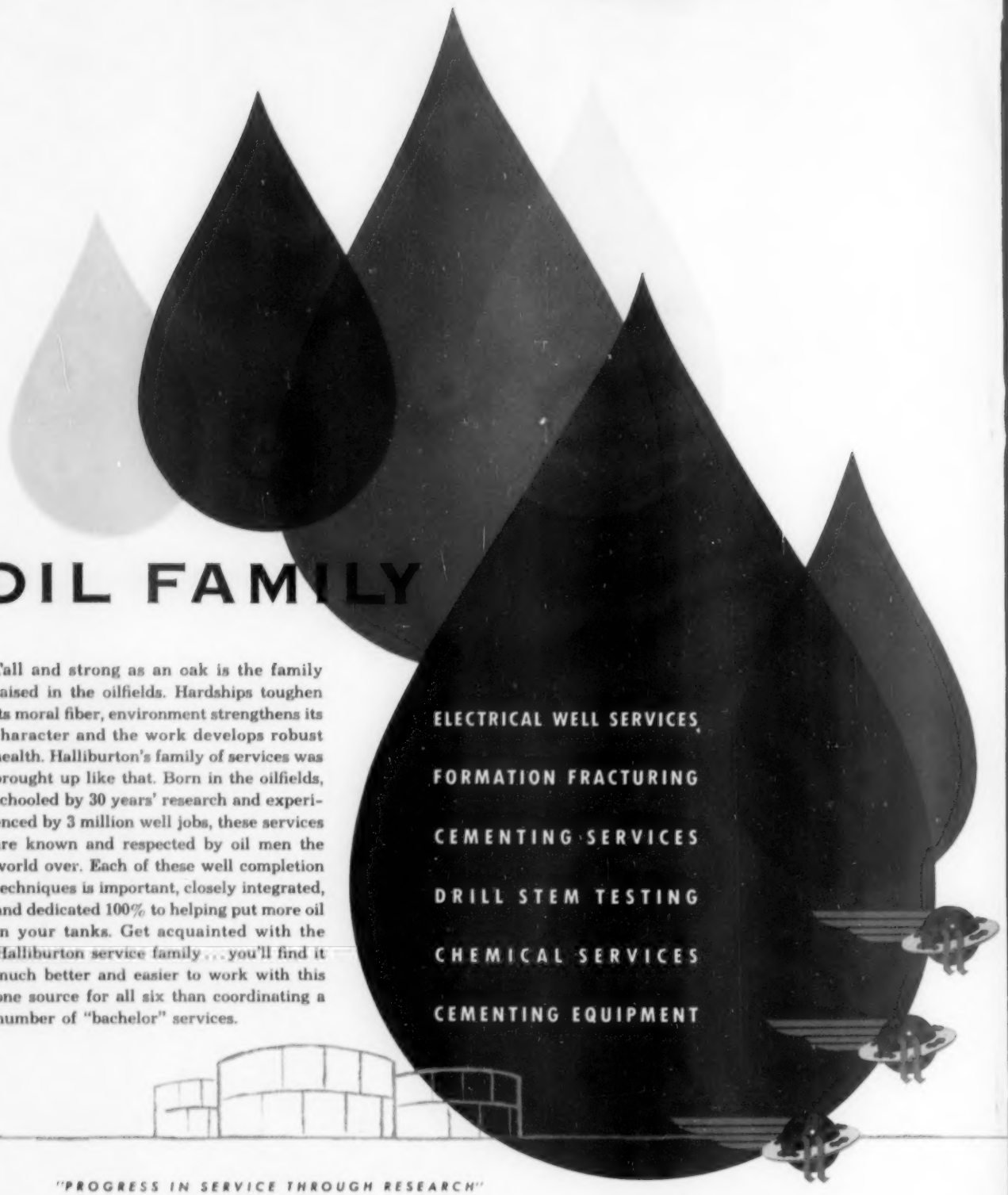

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A Glance Ahead . . . . at press time

These trends will make TOMORROW'S NEWS

Tight supply of line pipe has delayed construction of at least one big-inch pipeline. Some small-diameter lines previously were shoved back into the files until more pipe is available.

Tecumseh Pipe Line Co. won't get its proposed crude line started until next summer. The 190-mile, 20-in. line was scheduled to be built this year from East Chicago to Cygnet Ohio. Tecumseh is owned by Sinclair, Pure, and Ashland.

The over-building of basic synthetic anhydrous ammonia capacity in this country is beginning to be felt. Several major manufacturers of ammonia and nitrogen chemicals have cut the ammonia price from $85 to $80 per ton in carload capacities and similar reductions have been made in liquid and solid products.

Ammonia capacity now stands at more than 33 million short tons per year, with demand running about 85 per cent of that figure. More new plants are being built in areas where they will enjoy a shipping cost advantage, but they will tend to back up further production in existing facilities.

More warm water floods in Alberta's important Pembina field may be in the making.

Other operators reportedly are taking a close look at the Lewis Engineering report. It showed fabulous returns possible from flooding and was the basis for a 11,200-acre project in southeast Pembina started by a group headed by Canadian Seaboard (The Oil and Gas Journal, June 11, page 80). Some major operators are expressing definite interest in organizing projects in other Pembina areas.

Somewhere in the U. S. this month, a refiner is placing the 1,000,000th barrel of domestic catalytic reforming capacity on stream. Who that refiner may be is problematical, but the Journal's annual refining survey shows a number of candidates.

The catalytic reforming boom is one of the miracles of the oil business. Although the first units were operating during World War II, the real push did not start until about 5 years ago. Today, about one-quarter of all premium grade gasoline and more than 20 per cent of the total gasoline pool marketed in the U. S. is composed of aromatic hydrocarbons, derived mostly from catalytic reforming.

Atlantic Refining plans an aggressive development program on more than 400,000 acres of nonproducing leases acquired from Houston Oil. Under terms of the purchase, 85 per cent of the oil and gas from currently producing properties will go toward production payments. However, Atlantic will not have to make production payments from any new fields which may be discovered on undeveloped properties.

Geophysical work in southern Louisiana is on the upswing. Many crews now are concentrating their attention on deep oil prospects which may have been overlooked in past surveys. The trend is contributed largely to successful completion of the world's deepest well.

The OIL AND GAS JOURNAL

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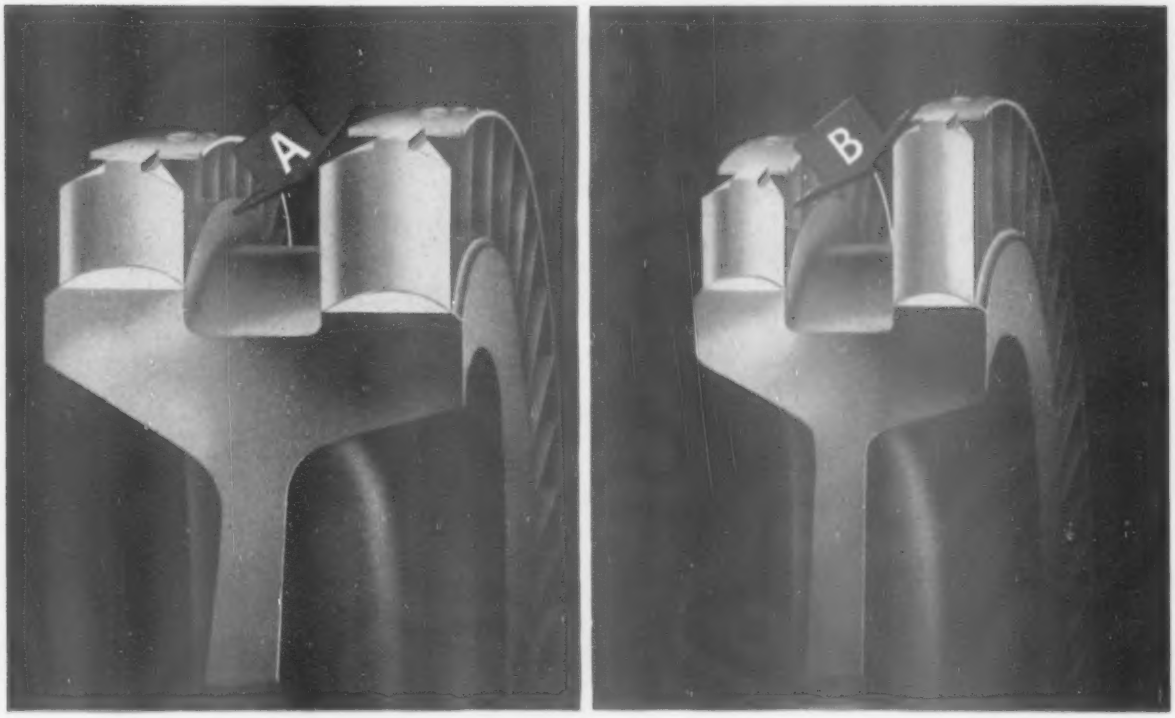

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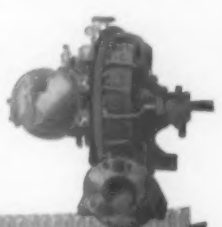

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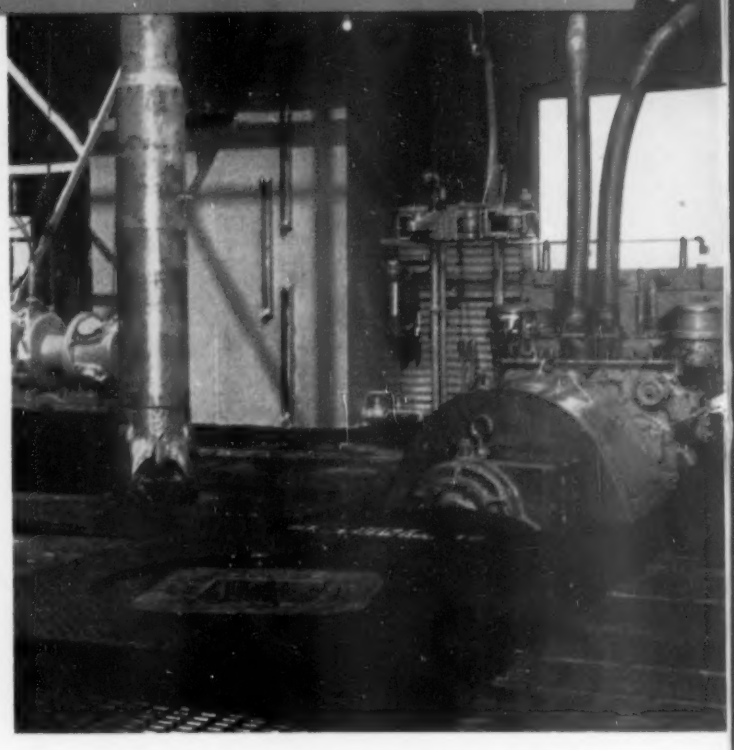

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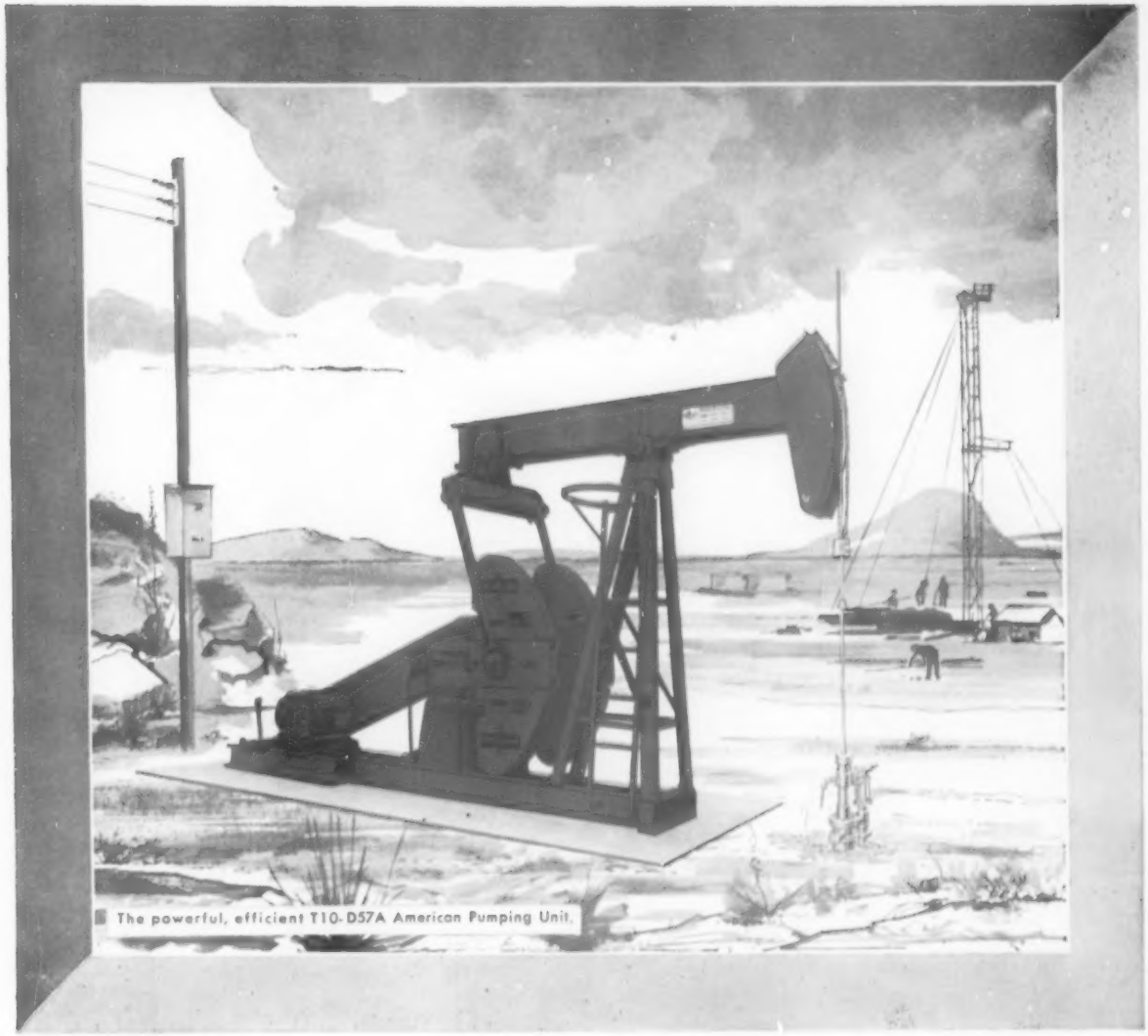

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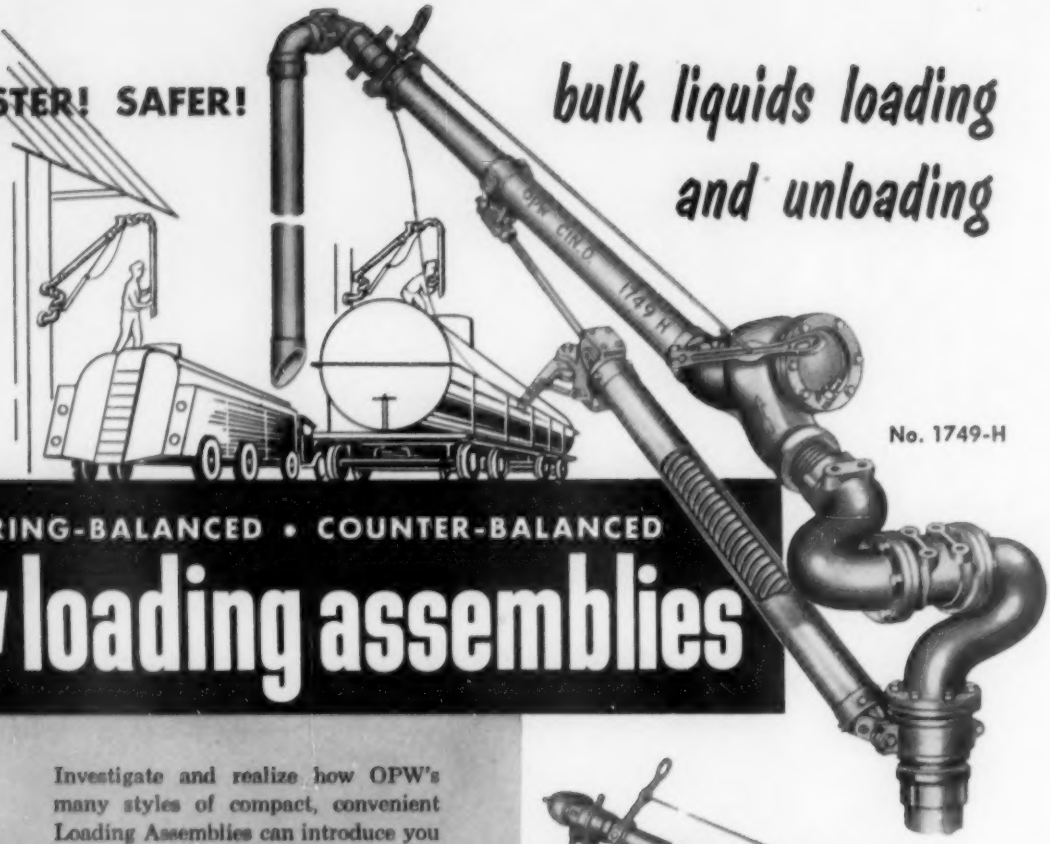

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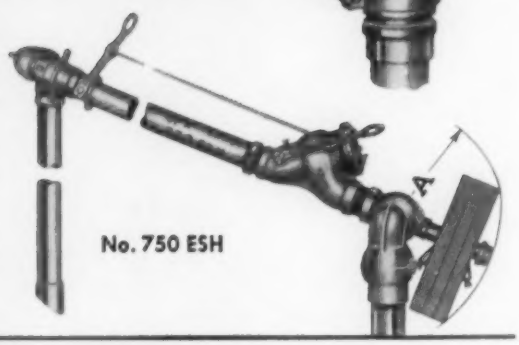

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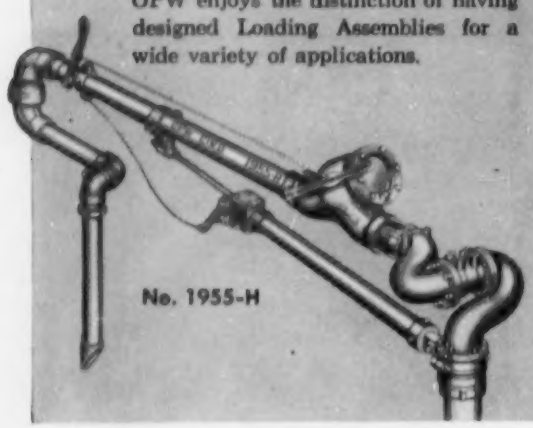

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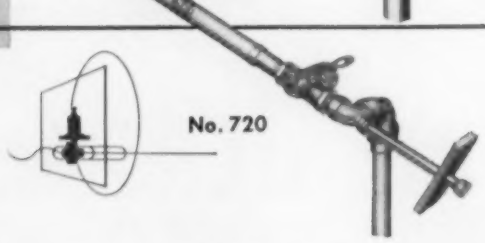

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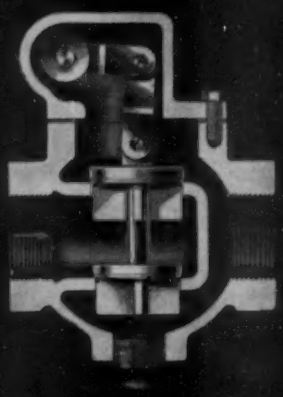
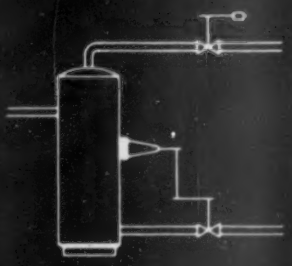


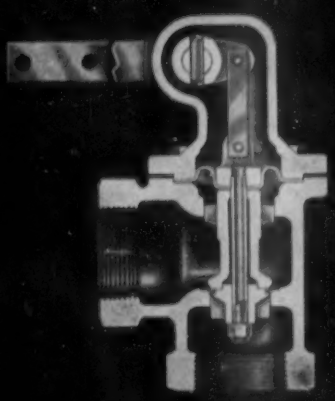
TYPE 9G—an economical and simple separator back pressure valve.

SIZES – Screwed 2", 3" and 4".
Flanged—3" and 4".



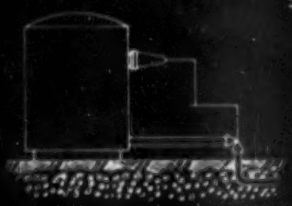
Low Pressure Separator Back Pressure Valve

OIL VALVE

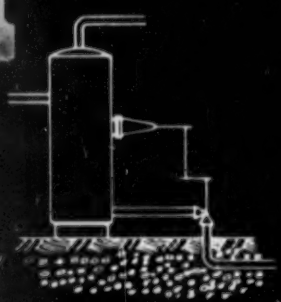


TYPE 1907 – for low pressure oil and gas separator. Also very successfully used as a water dump valve.

SIZES—Screwed 2" and 3".
Flanged – 2", 3" and 4".

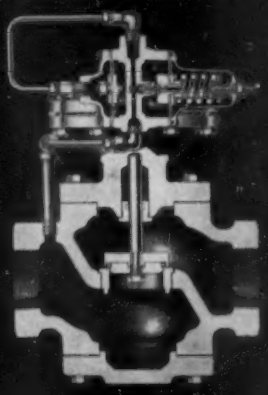


Water Dump Valve On Tank



Separator Low Pressure Oil Valve

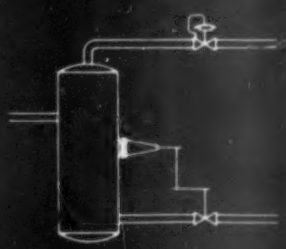
BACK PRESSURE VALVE



TYPE 63—here's a pilot operated valve that will give close regulation and tight shut-off.

SIZES—Screwed 2".
Flanged – 3" and 4".

Field Back Pressure Valve



Separator Low Pressure Back Pressure Valve

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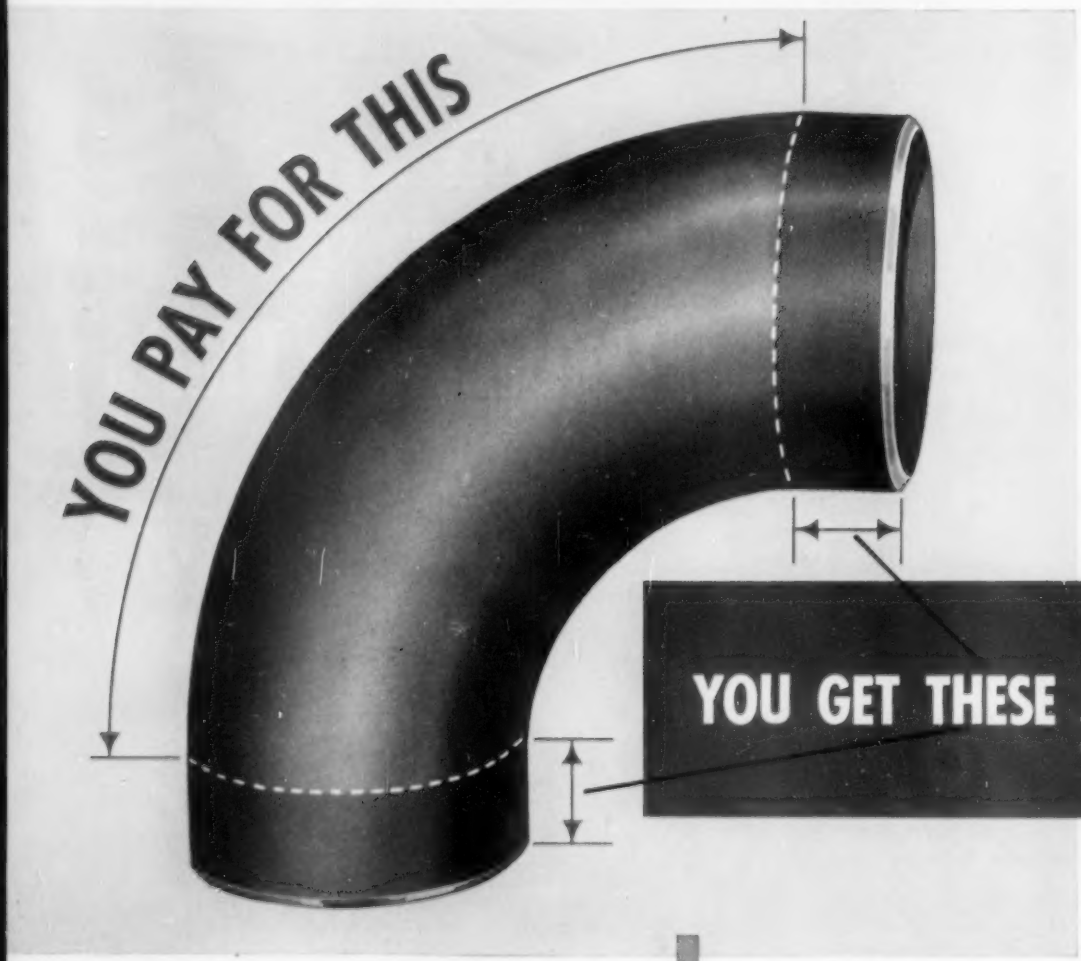
WSW 06045-78

JOY

WORLD'S LARGEST BUILDER OF PORTABLE ROTARY OIL FIELD DRILLS, CORE DRILLS, AND BLAST HOLE DRILLS

MIDWEST "LONG TANGENT" ELBOWS



In no other welding elbow do you get this "bonus" of long tangents. The dotted lines show where standard elbows end. Each shaded straight end equals ¼ of the nominal fitting diameter . . . a 12" Midwest "Long Tangent" Elbow has tangents 3" long. As a result of the advantages listed at the right, substantial savings are made on many piping systems by using Midwest "Long Tangent" Elbows . . . which cost no more than other elbows. For further information, write for Catalog 54.

MIDWEST PIPING COMPANY, INC.
Main Office: 1450 South Second Street, St. Louis 4, Mo.
Plants: St. Louis, Clifton, N. J. and Los Angeles
Sales Offices:
New York 7—50 Church St. • Chicago 3—79 West Monroe St.
Boston 27—426 First St. • Los Angeles 33—520 Anderson St.
Houston 2—1213 Capitol Ave. • Tulsa 3—224 Wright Bldg.
Cleveland 14—616 St. Clair Ave. • Miami 34—2103 Le Jeune Rd.
STOCKING DISTRIBUTORS IN PRINCIPAL CITIES

ADVANTAGES OF MIDWEST "LONG TANGENT" ELBOWS

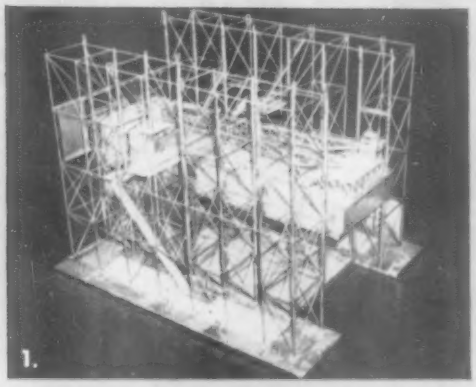
- ★ They save pipe.
- ★ They often eliminate short nipples and their extra welds.
- ★ They save time and money in lining up and clamping pipe and fitting.
- ★ They make it easier to apply slip-on flanges.
- ★ They remove the circumferential weld from point of maximum stress and can be sleeved.
- ★ THEY COST NO MORE THAN OTHER ELBOWS

MIDWEST HAS THE MOST COMPLETE LINE

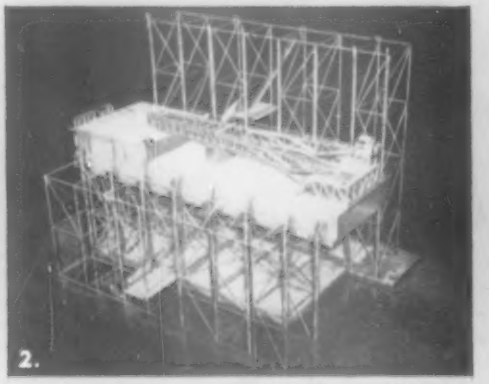
7325

MIDWEST WELDING FITTINGS IMPROVE PIPING DESIGN AND REDUCE COSTS

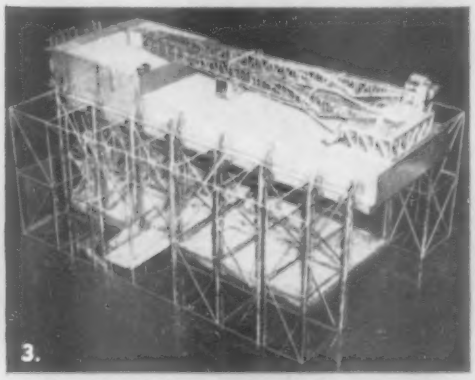
Higgins Deep-Water Platform* Interests Oilmen



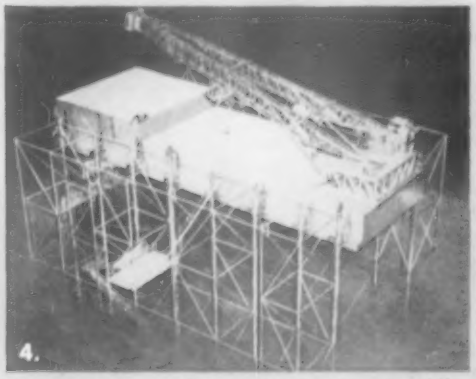
1. Operating model shows 3-section unit as towed to job in offshore field. Sections are secured by special devices which prevent parting, regardless of weather.



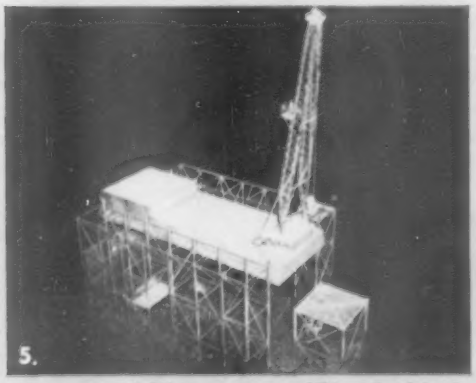
2. First, one of the outer sections is lowered so that pontoon rests on bottom of Gulf. Landing platform for service vessels is now in position.



3. Other outer section is next submerged. (Special wave-making device in model tank demonstrates how model withstands heavy gales.)



4. Center pontoon is lowered to bottom, providing broad base of support for drilling structure. Drilling platform and service decks, including helicopter landing deck, remain at top. Mast is raised.



5. With use of drilling mast as stiff-leg derrick the well-head protective jacket is set into drilling position. The new Higgins rig can be designed for depth up to 250 feet.

CHECK THESE ADVANTAGES

- Simplified construction reduces initial and maintenance costs.
- Ample clearance above mean gulf level permits operation under adverse conditions.
- Utmost stability, even during lowering and raising operations, makes for greater operating safety.
- Suitable spread footing offers sufficient resistance to movement from external forces.
- Large bearing area permits variation of bottom pressure to offset soil limitations in certain areas.
- Integrated units permit ease of transportation through locks, bridges and channels.
- Supply handling simplified to save time and thus further reduce operating costs.
- Makes possible the use of shallow-water drilling barges for deep-water operations.

* Patent Applied For

Q. Got a marine problem? **A. Get hold of Higgins INC.**

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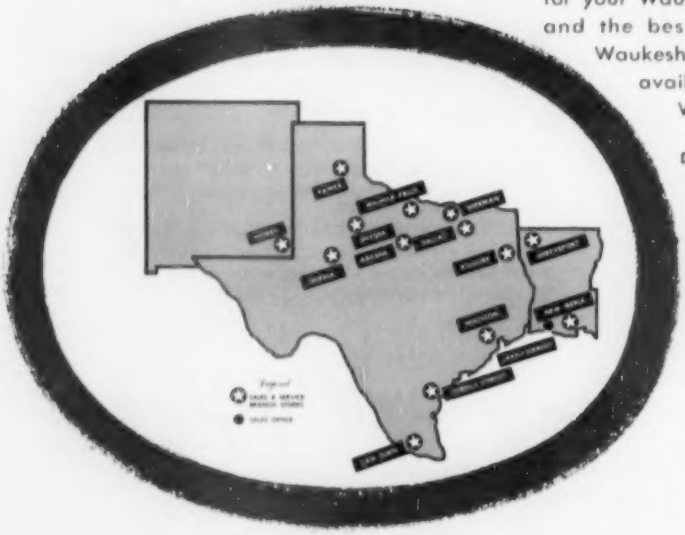
Don't take a chance. Buy genuine Waukesha parts from the Waukesha Sales and Service, Inc. store near you.



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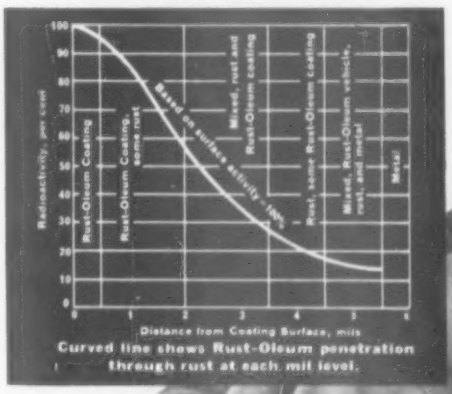
There is only one Rust-Oleum . . . it is as distinctive as your own fingerprint.

RUST-OLEUM® STOPS RUST!

Penetration through rust to bare metal traced by Geiger Counter—Utilizing a modern tool of science, Rust-Oleum's *specially-processed* fish oil vehicle was radioactivated and formulated into Rust-Oleum 769 Damp-Proof Red Primer—then applied to rusted test panels. Geiger Counters then traced Rust-Oleum's *specially-processed* fish oil vehicle through rust down to bare metal. Because of this penetration, you can apply Rust-Oleum directly over sound rusted surfaces—usually eliminating costly surface preparations. Write for your copy of the thirty-page report entitled, "The Development of a Method To Determine The Degree of Penetration of a Rust-Oleum Fish-Oil-Based Coating Into Rust On Steel Specimens," prepared by Battelle Memorial Institute technologists.

RUST-OLEUM CORPORATION
2542 Oakton Street, Evanston, Ill.


Radioactivity, per cent
Rust-Oleum Coating
Rust-Oleum Coating some rust
Based on surface activity = 100%
Mixed, rust and Rust-Oleum coating
Rust, some Rust-Oleum coating
Mixed, Rust-Oleum vehicle, rust, and metal
Metal
Distance from Coating Surface, mils
Curved line shows Rust-Oleum penetration through rust at each mil level.

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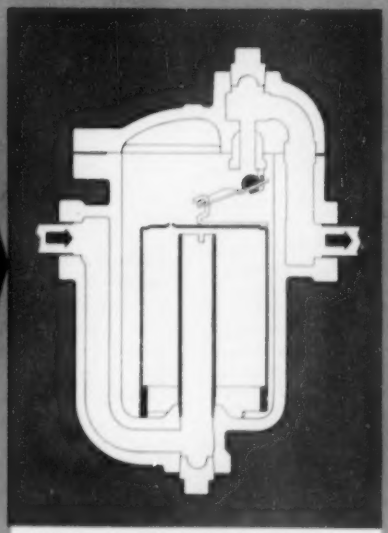
Rust-Oleum dries to a firm, decorative coating that resists sun, fumes, salt water, heat, humidity, weathering. Available in most colors.

See Sweets for complete catalog, or write for information. Prompt delivery from industrial distributor stocks.

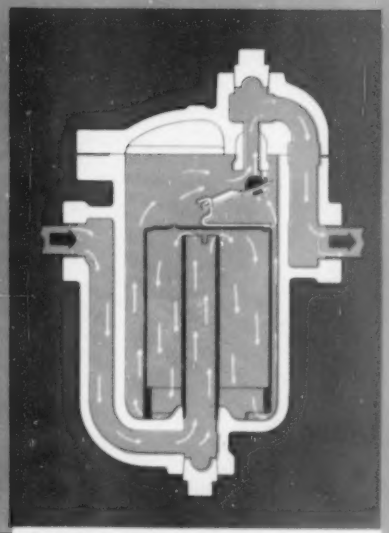
Rust-Oleum is available in practically all colors, including aluminum and white

How Armstrong Trap Design

Picture of PROFITABLE TRAP PERFORMANCE

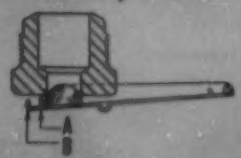


1. When trap is first installed, the inverted bucket is down and the valve is wide open. The large clearance between valve and seat minimizes restriction to condensate flow, contributing to large capacity.



2. When steam is turned on, note how condensate (solid color) flows down between bucket and trap body, then up and out through orifice. Dirt is held in suspension and washed out when valve opens.

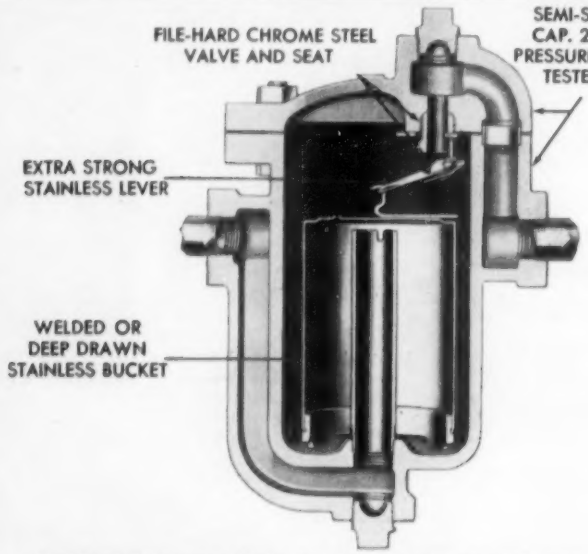
Two-Phase Leverage Provides High Capacity for Trap Size



Valve in closed position.

As bucket starts to sink, the lever fulcrums at "A", giving high leverage to open the valve against pressure. When valve is well open, the secondary fulcrum "B" touches the face of the valve seat.

Additional bucket travel results in fulcrum "B" becoming the pivot, permitting the valve to be opened wider so that restriction to flow of condensate is minimized.

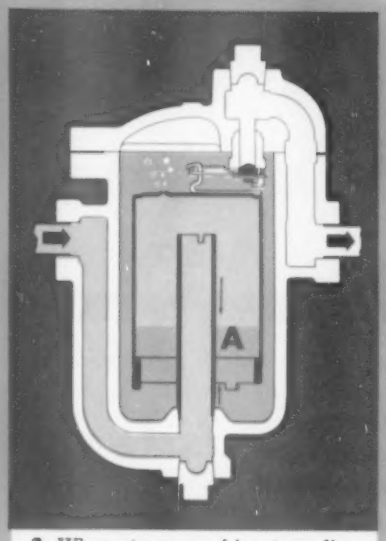

FILE-HARD CHROME STEEL VALVE AND SEAT
SEMI-STEEL BODY AND CAP. 250 LBS. DESIGN PRESSURE—HYDROSTATIC TESTED AT 500 LBS.
EXTRA STRONG STAINLESS LEVER
WELDED OR DEEP DRAWN STAINLESS BUCKET

Look at this trap. Only two moving parts. It's non-clogging, non-sticking, made of corrosion resistant materials. It will provide trouble-free service for years and years.

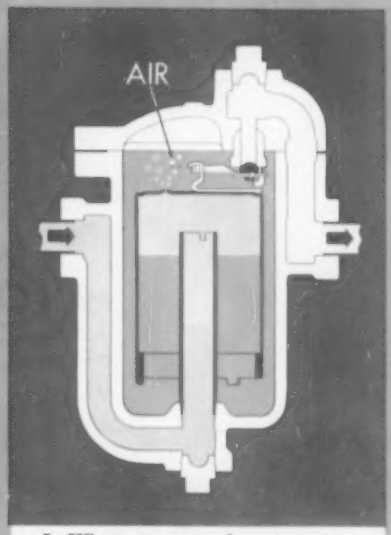
ARMSTRONG STEAM TRAP

ARMSTRONG *Inverted*

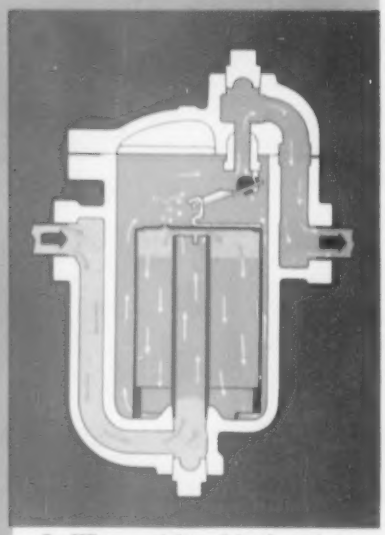
Improves Plant Efficiency . . .



3. When steam reaching trap displaces less than ½ of the water in the bucket, it floats, closing the valve. Generous safety margin (dimension A) insures that steam will never reach trap orifice.



4. When more condensate enters trap, the bucket loses buoyancy and pulls on valve lever. (Note how incoming air passes through bucket vent and collects at top of trap, awaiting discharge.)



5. When weight of bucket times leverage overcomes pressure on valve, trap opens, creating momentary pressure drop that "pumps" condensate and non condensibles from unit being drained.

Time-Tested Inverted Bucket Principle Provides Five Cost-Reducing Benefits:

"The bucket is upside down!" they cried, when Adam Armstrong marketed his first steam trap in 1911. Well, it is still upside down and it is the most widely used and most widely imitated trap for draining process equipment in the world today. The reason is simple—the basic principle has stood the test of time against all others on every type of application.

The modern Armstrong Trap is unsurpassed in these five major contributions to plant operating efficiency:

1. Fast heat-up—thanks to large condensate and air handling capacity. On batch or cycled production, you get maximum output per day.

2. High heat transfer rate—quick opening creates a sudden surge of condensate and air from the unit being drained. This pumping action prevents stratification of incondensibles and insures complete drainage. Laboratory and field tests prove it produces higher heat transfer than is otherwise possible.

3. Low Fuel Consumption—non-productive radiation losses are minimized because condensate is discharged at steam temperature as fast as it accumulates in the trap—you get more production per hour and per unit of fuel. And, there is no steam loss through the trap orifice.

4. Continuity of operation—the trap always opens for condensate; the simple, sturdy, self-cleaning mechanism insures continuous operation between inspections without interruption of processing.

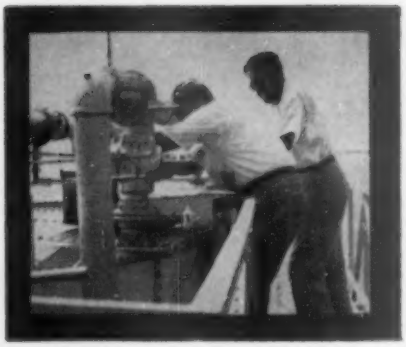
5. Low Maintenance — no trap has ever gained so enviable a record for trouble-free service—ask anyone who has kept records.

Free: Steam Trap Book—

44 helpful pages on trap selection, installation maintenance, physical data and prices. Call your local Armstrong Representative or Distributor, or write:

ARMSTRONG MACHINE WORKS
868 **Maple Street, Three Rivers, Michigan**

Bucket STEAM TRAPS



SERVICE

wherever oil is produced or refined

The Tretolite service organization provides competent, experienced advisory service wherever it can benefit the oil industry. In addition to the United States, service engineers are located in Canada, Mexico, Latin America and Europe.

Tretolite teams the best service possible with the best products possible. This policy is your assurance of money-saving results.

T-561

Chemicals and Services for the Petroleum Industry

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Demulsifying • Desalting • Water De-Oiling • Corrosion Inhibiting
Paraffin Removal • Scale Prevention • Production Stimulation

Gas Lift Service Causes Less "SHAKE, RATTLE AND ROLL" In a BS&B Spherical Separator!

Here's An Actual Case History From Our Files:

PROBLEM:

Freeport Oil Company needed a new production battery to handle the production from 2 wells, one of which was on gas lift, at one of their leases in Bayou Choctaw Field in Iberville Parish, La. Production from the gas lift well came in "slugs" with sufficient force to cause a serious vibration problem if put into a conventional type separator.

SOLUTION:

A BS&B Model "OGS" Spherical Separator was selected because of its ability to handle these "slugs" without undue vibration, and because of its separating efficiency. To complete the battery, the operator installed 2 BS&B 500 bbl. galvanized tanks and a BS&B Model "J" Vertical Treater, making his lease 100% BS&B equipped!

RESULT:

This production battery now handles approximately 210 bbls. of oil and 150 bbls. of salt water per day. In addition, approximately 330,000 MCF per day of gas lift gas is being run through the separator with excellent operating results.

Features Of The BS&B Spherical Separator

1. **Simple Hookup**
   Connections to top inlet and bottom outlets are easily made from any direction.
2. **Liquid Slugs**
   Internal design diverts liquid slugs rapidly to the liquid section.
3. **High Capacity**
   The large ratio of liquid surface area to volume in the liquid section allows rapid release of solution gas from the oil.
4. **Controls**
   All controls and valves are BS&B.
5. **Small Space Requirement**
   Compact design is a distinct advantage of the Model "OGS" over other separators.
6. **Servicing**
   Convenient access openings are provided to simplify periodic cleaning and blow-down.

EFFICIENCY OVER 60 YEARS BS&B RELIABILITY
ANOTHER EXAMPLE OF PRODUCT LEADERSHIP

BLACK, SIVALLS & BRYSON, INC.

Oil & Gas Equipment Division, Dept. 1-A6A

1708 West Main Street — Oklahoma City, Oklahoma

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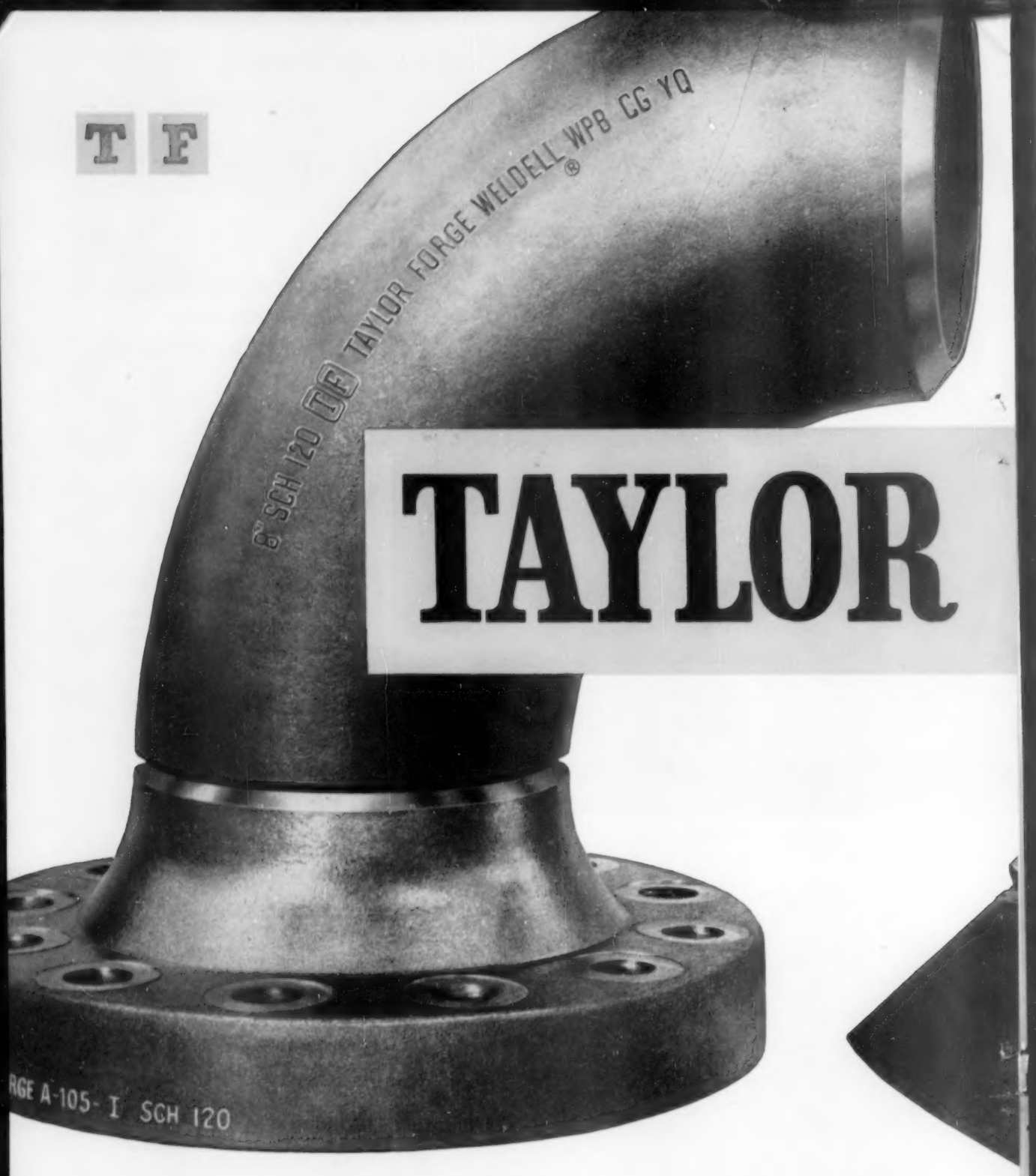


TAYLOR

Welding nozzles

T.E.M.A. flanges and channels

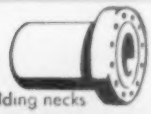
Multiple outlet headers

Production forgings

Venturi reducers

Spiral weld pipe

Large diameter electric weld pipe



Welding necks

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FORGE Welding Fittings and Forged Flanges

* Backed by 55 years' experience
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* Forged for maximum strength and stamina
* Guaranteed to meet all American Codes and Standards
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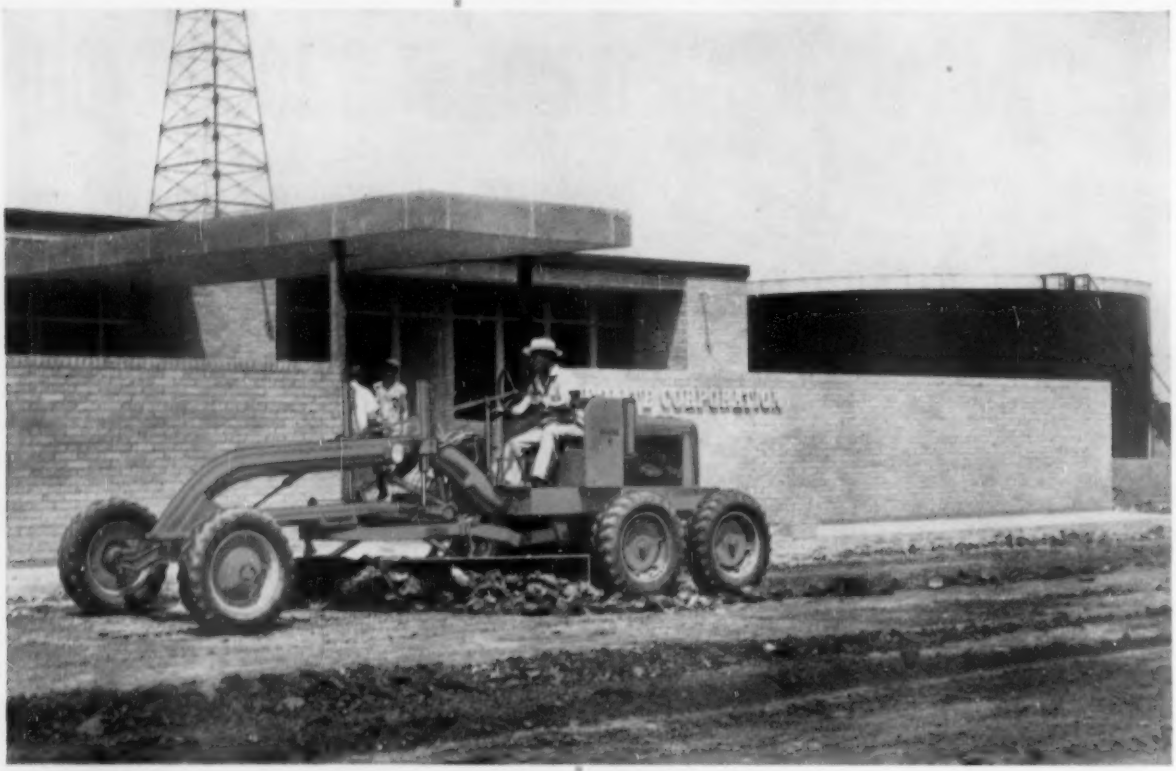
He carries a full stock of Taylor Forge Welding Fittings and Forged Flanges and can supply your needs promptly. He's a good man to know for he understands piping and through him you have available the services of Taylor Forge engineers for help and advice on any piping problem.

Allis-Chalmers model D

THE LOW-COST MOTOR GRADER THAT OFFERS OIL FIELD USERS more of everything...



more PRODUCTION-BOOSTING FEATURES

Choice of Allis-Chalmers engines

GASOLINE — 50 brake hp. Bare grader weight —8,800 lb. Four forward speeds to 25.6 mph, one reverse to 3.3 mph.

DIESEL — 50 brake hp. Bare grader weight — 9,350 lb. Four forward speeds to 25.2 mph, one reverse to 3.2 mph.

ROLL-AWAY moldboard rolls the load instead of pushing it, moves more dirt, uses less power.

Plus one-piece tubular frame, tandem drive, real operator comfort, hydraulic blade lift.

USEFUL OPTIONAL FEATURES

Power circle turn for faster, easier, better control of blade . . . turns 135 degrees.

Leaning front wheels with heavy-duty axle, for better control in close quarter-work.

Hydraulically shiftable moldboard to speed work around obstructions. Shifts 16 in. each way.

Special large tires for added traction, long wear. Front (7.50-20 or 8.25-20) and rear (8.25-20).

more JOB-MULTIPLYING ATTACHMENTS

Hydraulic scarifier, mounted amidships for maximum effective ground pressure.

Shoulder maintainer for safe, one-pass operation. Also available: one-pass windrow eliminator.

Rear-mounted 5/8-yd loader for fast, low-cost handling of materials.

plus snowplows, completely enclosed standup cab, hydraulically operated mower.

more SATISFIED USERS

Since its introduction in 1949, thousands of satisfied owners have *proved* the usefulness and low-cost versatility of the Model D on all kinds of construction and maintenance.

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ALLIS-CHALMERS, CONSTRUCTION MACHINERY DIVISION
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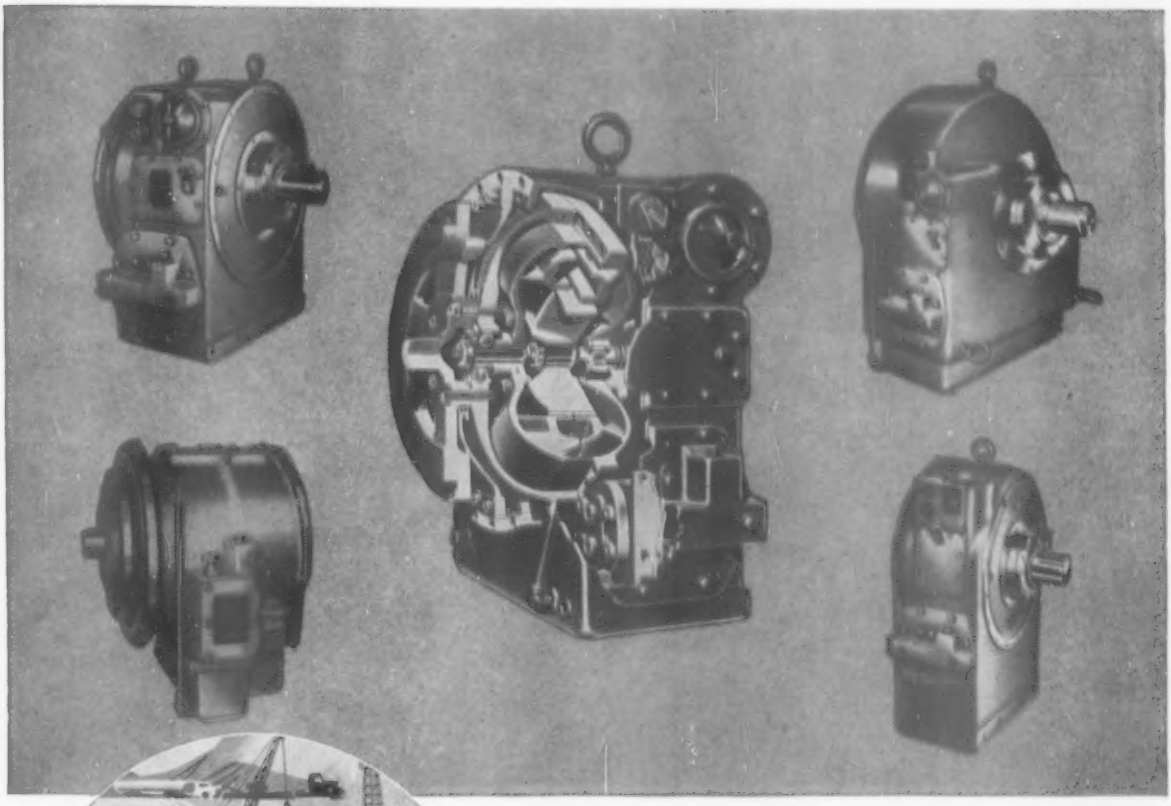
ROLL-AWAY is an Allis-Chalmers trademark.

of Taylor Forge engineers for help and advice on any piping problem.



For your power need, *whatever it is,* there's a "right" TORCON Model

With a horsepower range from 15 to 600, and fly-wheel diameters from 11 to 26 inches, Torcon has a model that's right for your need — a standard unit available immediately for original equipment or for field installation

Your real benefits begin after Torcon is installed—

- **more work and less wear: Torcon blade design balances engine efficiency and horsepower through the working range—smooth, shockless power that reduces wear, prolongs life**
- **integral unit includes oil pump, sump, pressure regulator; much better efficiency with minimum maintenance**

Are you constantly on the look-out for ways to get more efficient power at less cost? Talk to Clark—on all problems of power transmission, from flywheel to point of torque application. You'll find, as do many leading equipment manufacturers, that it's "good business to do business with Clark".

CLARK EQUIPMENT COMPANY, Transmission Division

Falahee Road • Jackson 15, Michigan

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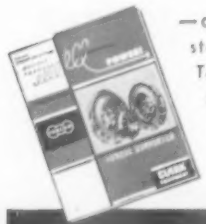
SEND FOR THIS TORCON BULLETIN



—a concise, helpful statement on how Torcon installations cut operating costs, prolong equipment life.

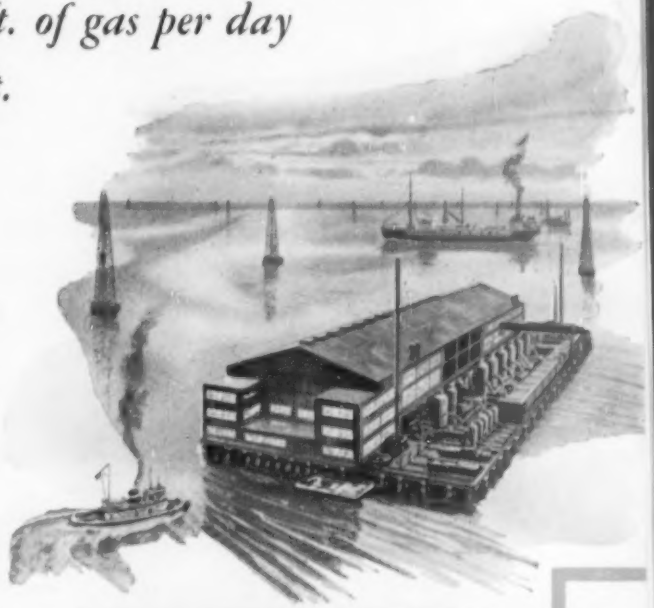
CLARK® EQUIPMENT

10 **Ingersoll-Rand turbo-compressors now serving**

Creole's outstanding offshore repressuring plant

increase oil recovery from Lake Maracaibo reservoir*

Arranged in 7 stages of compression, ten I-R Compressors are delivering 137,000,000 cu. ft. of gas per day at 2,000 psi to oil pools 4,500 ft. underneath the lake



CREOLE PETROLEUM CORPORATION'S huge $20 million gas-compression plant is the largest gas conservation project so far completed in Venezuela. Located on a pile-supported platform in Lake Maracaibo, it represents a bold concept in pressure maintenance for pushing petroleum up from a reservoir 4500 feet underneath the lake.

One of the plant's innovations is the use of 10 I-R multi-stage centrifugal compressors, specially designed for this outstanding project. Arranged in 7 stages of compression, the compressors are driven by 60,000 hp of combustion-gas-turbines. Handling gas from the lake's well heads, they compress it from 10 to nearly 2000 psi—the highest operating pressure ever attained with centrifugal compressors—and then force the gas back into the ground.

For information on these or any other Ingersoll-Rand air and gas compressors or blowers, contact your nearest I-R engineer.

*ATTESTING the efficiency, economy and dependability of I-R equipment in such continuous, heavy-duty service, 12 more I-R compressors have been ordered for still another and larger repressuring plant on Maracaibo which Creole is now constructing.

Ingersoll-Rand

12-392

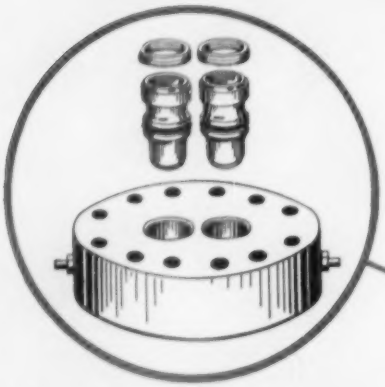
11 Broadway, New York 4, N. Y.

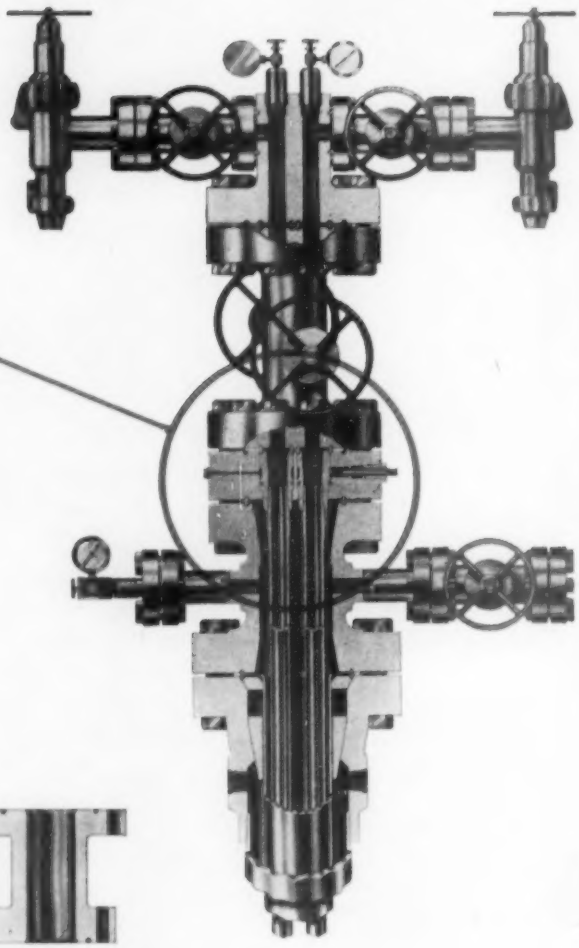
10 gas-turbine-driven Ingersoll-Rand centrifugal compressors, passing gas through 7 stages of compression from 10 to 2000 psi.

Simplified flow diagram of Creole's huge pressure maintenance plant.

RECTOR Dual-String Hanger Flange

Outstanding Simplicity and Flexibility, plus the FAMOUS Rector Metal-to-Metal Seal

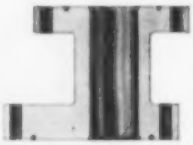




SIMPLICITY: The flange has two full opening tapered bores in which the strings are suspended by threaded mandrels. This eliminates mating and sealing two tubing hangers in a single, large bore. Each string can be suspended, temporarily sealed, and held down independently of the other assuring maximum ease of installation with complete control of well.

FLEXIBILITY: Regular 2" API upset tubing can be run or pulled through the bores in the flange.

METAL-to-METAL SEALS: Each mandrel is independently sealed by a metal seal ring in the groove at the junction of mandrel and flange. This metal-to-metal sealing arrangement also acts as a hold-down. "O" Rings on the mandrel provide a temporary seal during completion and permit testing the seal after Christmas Tree is installed. Mandrels are grooved for hold-down locking screws, which are optional in the flange.



Off-Set Adapter Spool permits use of regular preventer equipment with alignment directly over each individual bore while running and pulling tubing. After first string is run, Adapter Spool can be rotated to center directly over the other bore.

• **Rector Dual-String Hanger Flanges are available in Nom 6 and Nom 8 sizes in any series. Mandrels are interchangeable.**

For maximum simplicity and flexibility of dual-string suspension, plus the metal-to-metal seal that never requires maintenance or replacement, specify a Rector Dual-String Hanger Flange in your dual completion Christmas Tree.

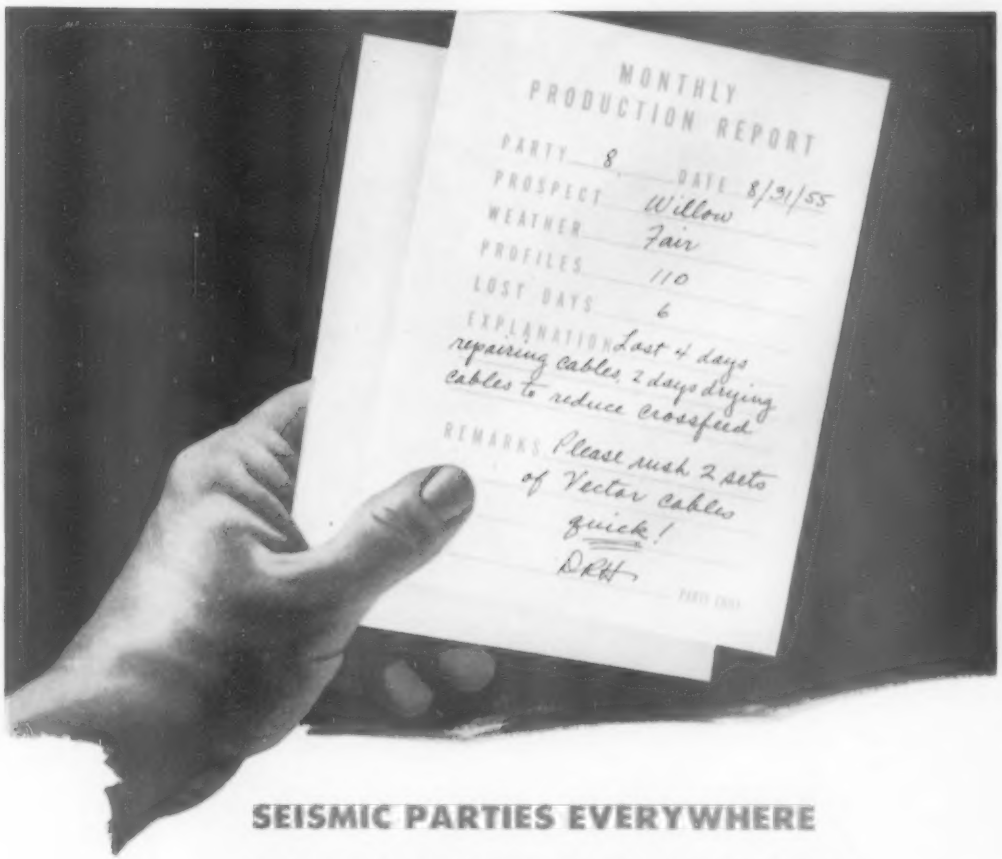
RECTOR WELL EQUIPMENT COMPANY INC

MAKING THE OIL INDUSTRY SAFER

3100 NORTH COMMERCE ST. FORT WORTH, TEXAS

Houston Plant: 2215 Commerce St.

REPRESENTATIVES IN ALL ACTIVE FIELDS



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Vector GEOPHYSICAL CABLES AND ACCESSORIES

In seismic exploration, time and money are identical. With today's high costs, the failure of one item of field equipment can pile up lost-time charges amounting to hundreds of dollars in only a few hours. That's why **top quality** equipment is always . . .

the most economical answer to exploration problems.

Vector MANUFACTURING COMPANY

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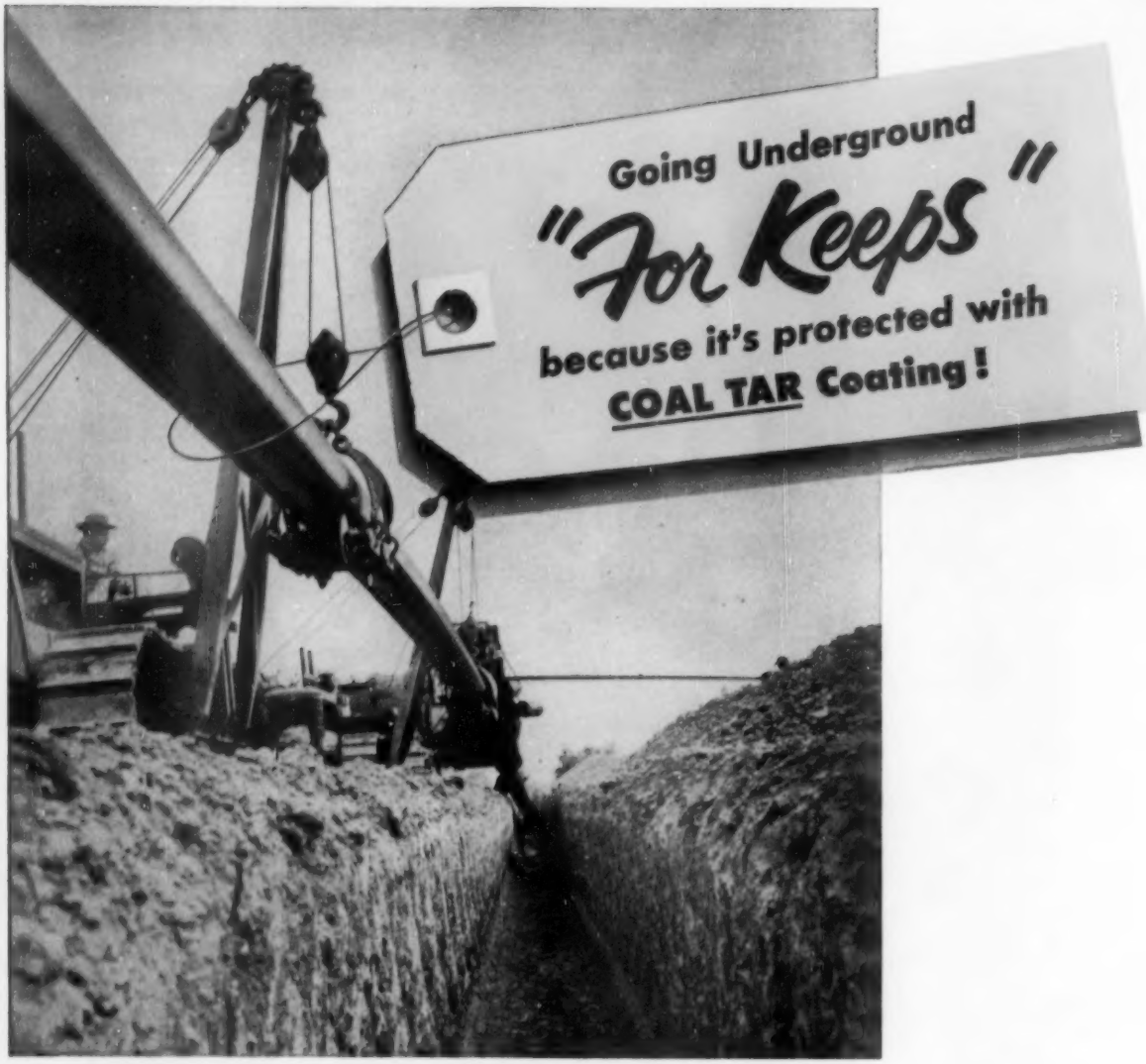

EACH year an overwhelming majority of pipeline owners and operators select *coal tar* coatings to protect their long-term investment. And with good reason: No other material can match coal tar coating's *proven* record of economical, long-lasting protection.

Coal tar coatings are amazingly durable. And their life is measured in decades—thanks to their inherent ability to resist soil stress and water absorption, the two big reasons why other materials fail.

If you'd like to be sure of the *best* pipeline protection that money can buy, specify *Pitt Chem* Coal Tar Coatings, just as scores of leading pipeline companies do. When you buy *Pitt Chem,* you buy *assured* pipeline protection with every drum, because *Pitt Chem* Coal Tar Coatings are manufactured to rigid, *published* specifications by a basic producer. If *you* have a pipeline protection problem, chances are we have the answer. *A phone call will place an experienced Pitt Chem man at your service.*

PITT CHEM® TAR BASE COATINGS

Standard Grade · Modified Grade
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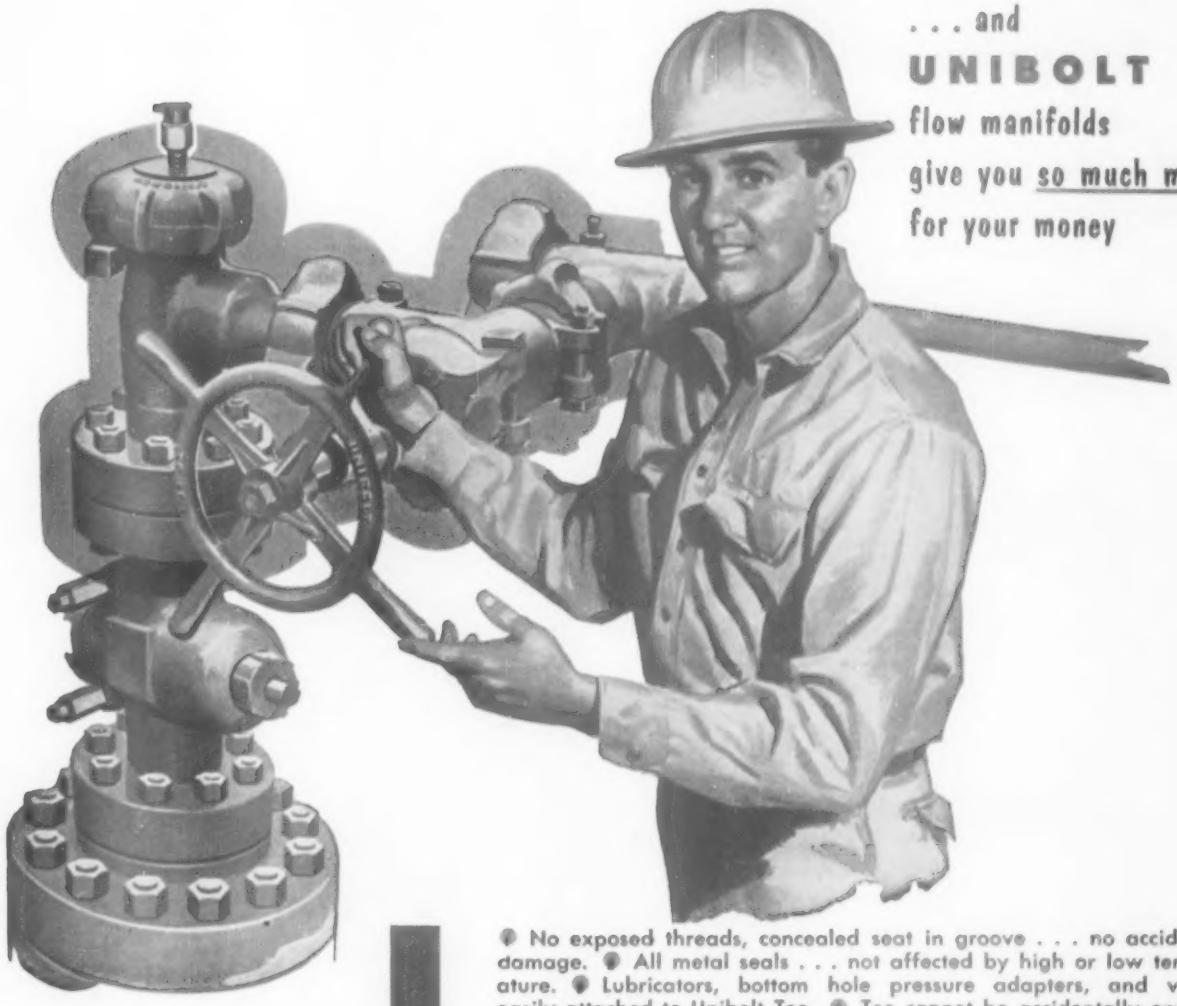
COAL CHEMICALS • PROTECTIVE COATINGS • PLASTICIZERS • ACTIVATED CARBON • COKE • CEMENT • PIG IRON

It costs so little more to "go first class"

. . . and
UNIBOLT
flow manifolds
give you <u>so much more</u>
for your money



Pressure-tested as a unit and available in a full range of pressures:

3000 lbs. w.p.
5000 lbs. w.p.
10000 lbs. w.p.

and in "SA" stainless steel for corrosive conditions.

● No exposed threads, concealed seat in groove . . . no accidental damage. ● All metal seals . . . not affected by high or low temperature. ● Lubricators, bottom hole pressure adapters, and valves easily attached to Unibolt Tee. ● Tee cannot be accidentally opened. ● Unibolt stronger than tubing threads . . . ideal for working trees with welded lift nipple. Tubing threads in Tee if desired. ● Wing Valve requires no grease to effect seal. ● Variable opening speeds up initial clean-up or running initial flow tests . . . saves rig time. ● Unrestricted 1" opening in Wing Valve will pass 10,000 bbls. fluid per day with 100 lbs. pressure drop. ● Valve stem packing needs no tightening . . . stem turns freely under high pressures. ● Threads on stem not exposed to internal or external damage . . . full 2½" pilot for true stem alignment and rigidity. ● Stem seat sealed by power threads and metal gasket assures alignment. ● Nitride hardened stem and stem seat . . . resists corrosion. ● Choice of hard chrome plated or "SA" stainless stems and seats. ● Positive Choke Body takes regular or "X" Beans . . . all beans flow-rated. ● Shaped entrance on beans prevents paraffin clogging. ● Positive Choke Body may be replaced with inexpensive tee and cage nipple, or can be converted to Adjustable Wing Valve by substituting two parts. ● Streamlined flow . . . no obstructions . . . no turbulence.

THORNHILL CRAVER CO.
P. O. BOX 1184 HOUSTON, TEXAS

IT'S NEARING COMPLETION...
PACIFIC NORTHWEST PIPELINE'S
"SCENIC INCH"

Winding across New Mexico's deserts, climbing the snow-capped Colorado Rockies and ending at last in the evergreen country of Oregon and Washington . . . Pacific Northwest Pipeline Corporation's 2300-mile "Scenic Inch" is being rushed to completion.

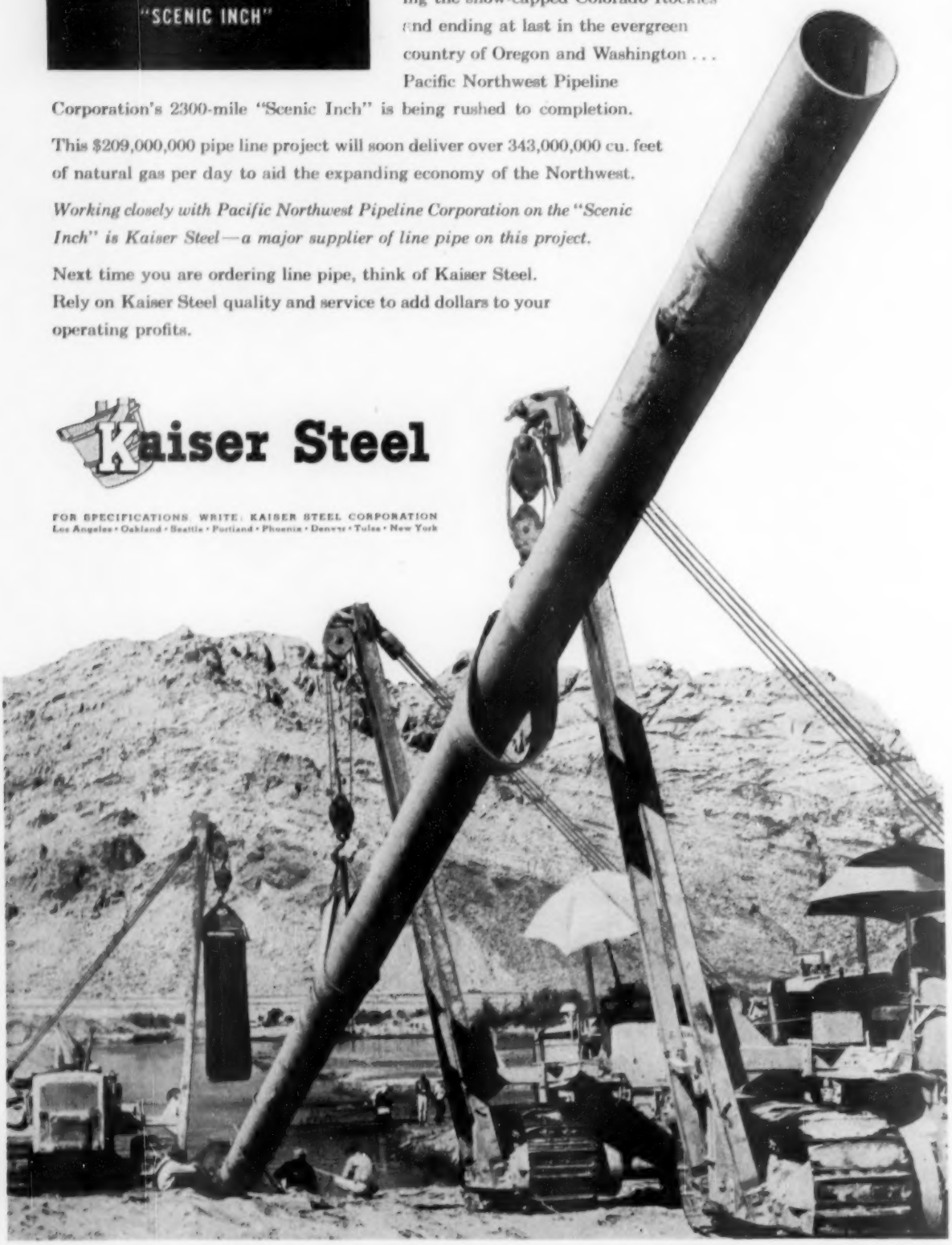
This $209,000,000 pipe line project will soon deliver over 343,000,000 cu. feet of natural gas per day to aid the expanding economy of the Northwest.

Working closely with Pacific Northwest Pipeline Corporation on the "Scenic Inch" is Kaiser Steel—a major supplier of line pipe on this project.

Next time you are ordering line pipe, think of Kaiser Steel. Rely on Kaiser Steel quality and service to add dollars to your operating profits.

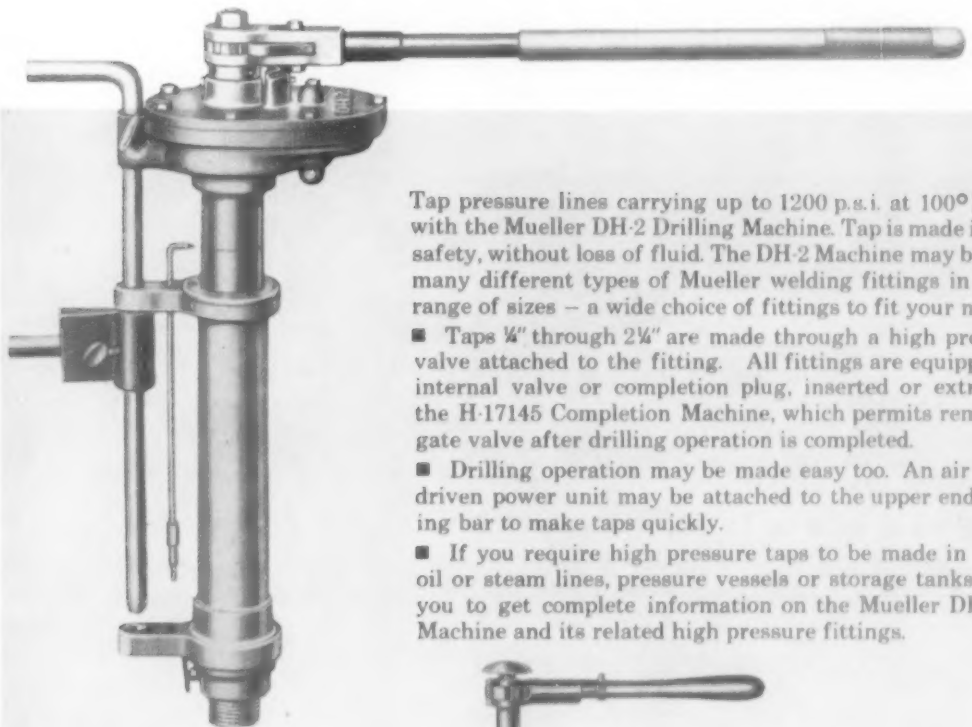
Kaiser Steel

FOR SPECIFICATIONS, WRITE: KAISER STEEL CORPORATION
Los Angeles • Oakland • Seattle • Portland • Phoenix • Denver • Tulsa • New York



MUELLER

HIGH PRESSURE TAPS!



Tap pressure lines carrying up to 1200 p.s.i. at 100° Fahrenheit with the Mueller DH-2 Drilling Machine. Tap is made in complete safety, without loss of fluid. The DH-2 Machine may be used with many different types of Mueller welding fittings in a complete range of sizes – a wide choice of fittings to fit your needs.

- Taps ¼" through 2¼" are made through a high pressure gate valve attached to the fitting. All fittings are equipped with an internal valve or completion plug, inserted or extracted with the H-17145 Completion Machine, which permits removal of the gate valve after drilling operation is completed.
- Drilling operation may be made easy too. An air or gasoline driven power unit may be attached to the upper end of the boring bar to make taps quickly.
- If you require high pressure taps to be made in water, gas, oil or steam lines, pressure vessels or storage tanks, it will pay you to get complete information on the Mueller DH-2 Drilling Machine and its related high pressure fittings.

DH-2 Drilling Machine

Taps ¼" through 2¼" • Power or hand operated
Automatic or manual tool feed • 14" boring bar travel
Working pressures to 1200 p.s.i. at 100° F.
Working temperatures to 500° F. at 1000 p.s.i.

H-17145 Completion Machine

Inserts and extracts completion plugs or valve stems in fittings. Reconditions valve seats in valve tees.

NO-BLO

MUELLER CO.

Dependable Since 1857

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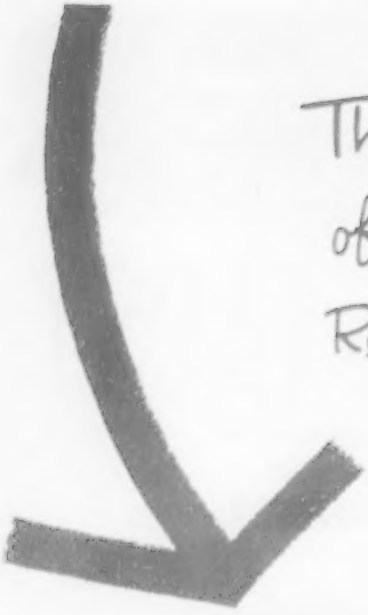
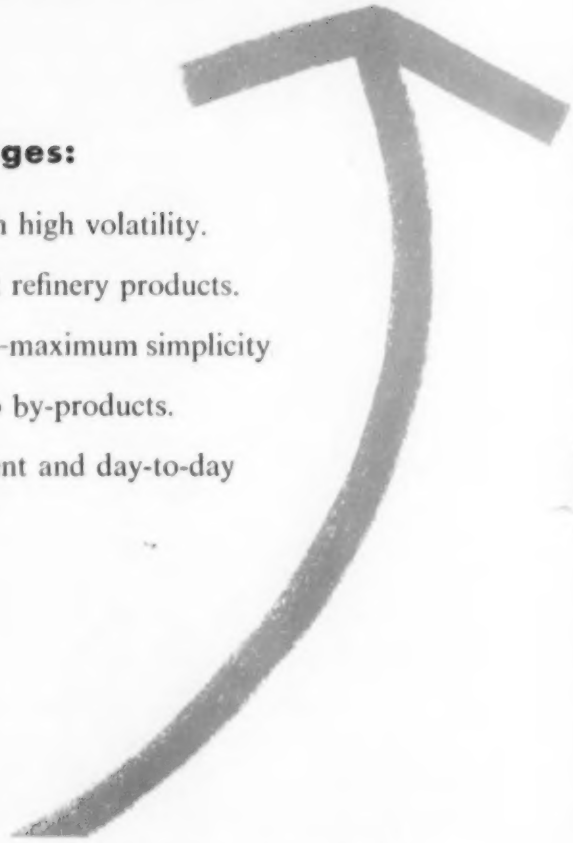


This is an announcement
of a brand new
Refining Process developed by
Universal Oil
Products Company

PEN



PENEX offers these advantages:

1. Provides a high octane product with high volatility.
2. Upgrades natural gasoline and light refinery products.
3. Affords mild, continuous operation—maximum simplicity
4. Clean reaction—insignificant loss to by-products.
5. Economy, both in original investment and day-to-day operation.

PENEX is an entirely new refining process which enables the refiner and natural gasoline manufacturer, for the first time, economically to upgrade his pentane and hexane fractions. It is a simple, continuous process that does not require regeneration, and utilizes a fixed-bed platinum-containing catalyst.

PENEX

TRADEMARK

PENEX converts the low octane straight chain pentanes and hexanes into the much higher octane iso-compounds, accomplishing this through a clean reaction with little or no loss to by-products. Unconverted portions of the feed stock are separated and recycled to provide the ultimate in octane improvement. This new process employs mild operating conditions, and the non-corrosive nature of the catalyst assures easy and long-sustained operation.

PENEX is available NOW!

PENEX is an important advancement in petroleum refining technology. It is ready to be put to work now. All refiners, everywhere, should investigate this new process fully either for early application or for consideration as part of their future planning.

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UNIVERSAL OIL PRODUCTS COMPANY

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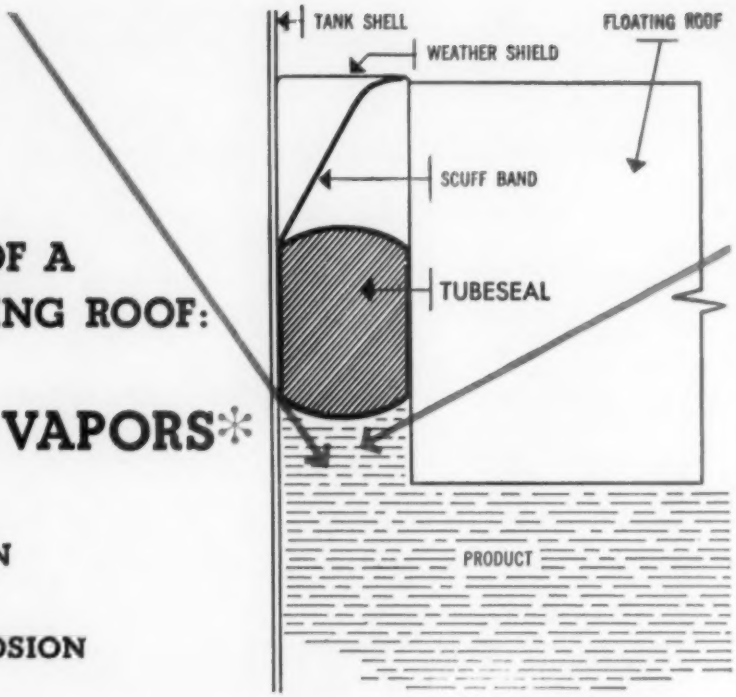
Forty Years Of Leadership In Petroleum Refining Technology

THE SECRET OF A GOOD FLOATING ROOF:

NO ROOM FOR VAPORS*

*NO EVAPORATION
NO FIRES
MINIMUM CORROSION



Because there is no space in a HAMMOND TUBESEAL FLOATING ROOF, where vapor can form, jet fuels and other volatile products can be stored with assurance that evaporation and fires cannot take place and further that corrosion will be kept to a bare minimum.

THE HAMMOND TUBESEAL

The most efficient and positive seal known: no moving parts · no mechanical maintenance · climate proof · non-corrodible · can operate to bottom of tank or above the top · no vapor space below the seal · entire circumference has tight seal under pressure at all times.

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The makers of TUBESEAL believe that its unique safety and economy factors should be allowed to benefit the broadest possible section of the petroleum industry. For that reason HAMMOND IRON WORKS will license its use on a non-exclusive basis. For further information write to:

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CHEAPER OVER THE YEARS

HAMMOND IRON WORKS

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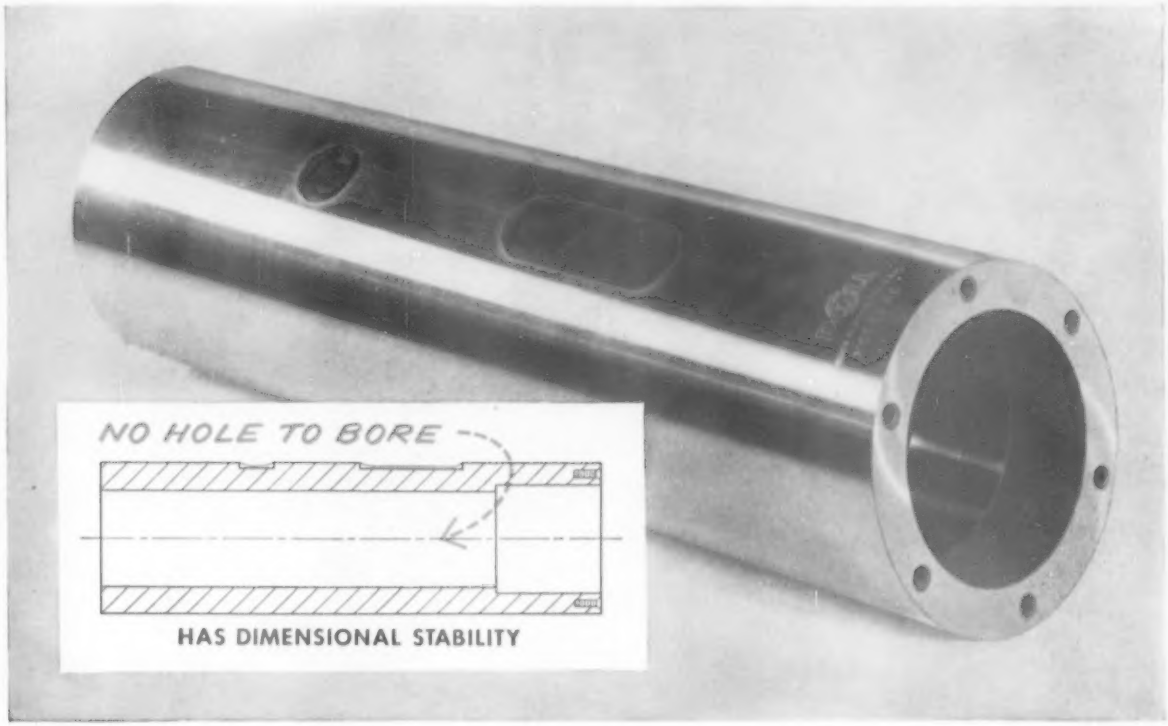
CASPER, WYO. • BIRMINGHAM, ALA.



DoALL switches to TIMKEN® seamless steel tubing —cuts spindle housing cost 26%

THE DoALL Company faced a tough problem in reducing production costs of its precision spindle housing, while retaining the required dimensional stability. Timken Company metallurgists came in, worked with DoALL's engineers and recommended a change from the bar stock previsously used to Timken® seamless steel tubing.

Immediate savings resulted. Machining time was cut. With Timken seamless tubing, the hole was already there. No drilling required. Scrap loss reduced. More parts produced per ton of steel. One of the annealing operations required with bar stock was eliminated.

DoALL and Timken Company metallurgists devised stress-relieving operations to insure complete stability in the finished part. By changing to Timken seamless steel tubing, DoALL's production cost per housing was cut 26% and thorough lab tests proved there were no dimensional changes in the finished part.

Timken Company metallurgists will gladly work with you on your hollow cylindrical parts jobs, to help you make important production savings with Timken seamless steel tubing. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS STEEL TUBING

PROGRESS THROUGH CHEMISTRY

Davison Announces
GYROCAT *
*T. M. Applied For
. . . A Line of Balanced High Stability Catalysts

Davison's GYROCAT catalysts are products of Davison research, development and manufacturing know-how, designed to meet the needs of all refiners.

Davison's Technical Service helps the refiner to choose from the wide selection available, the grade which he knows will have the best balance of physical, chemical and catalytic properties for his particular operation. This means maximum utilization and maximum profits from the fluid cracking process.

GYROCAT means balance and stability.

lity,

vison's Petroleum Catalysts

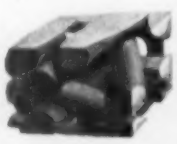
Davison has for many years been the leader in the production of catalysts. This leadership has been maintained through Davison's continuing ability to produce catalysts designed to meet the requirements of all types of fluid catalytic cracking units.

For information on Davison catalysts, see your Davison Representative, or write

DAVISON CHEMICAL COMPANY
Division of W. R. Grace & Co.
Baltimore 3, Maryland

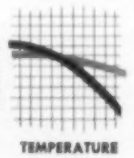
Sales Offices: Chicago, Ill.; Houston, Tex.; New York, N.Y.; Baltimore, Md.
In Canada: Davison Chemical Company Ltd., Toronto

Producers of: Catalysts, Inorganic Acids, Superphosphates, Triple Superphosphates, Phosphate Rock, Silica Gels and Silicofluorides. Sole Producers of DAVCO® Granulated Fertilizers.



Structural Stability, Catalyst in the form of submicroscopic filaments provides the surface area on which catalytic reactions take place. Large filaments give greater mechanical strength.

Thermal Stability, The graph compares high pore diameter catalysts (in blue) with ordinary catalysts. By resisting heat deactivation, high pore diameter catalysts have a higher useful activity.



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SIMPLIFIES INSTALLATION

Makes your work easier!

EVERYONE who specifies, buys and uses welding fittings and flanges has a mighty good reason for insisting on TUBE-TURN* products. *They simplify his work!* Being the world's most complete line, they *simplify piping design.* All available from one nearby source, they *simplify purchasing.* Of unsurpassed uniformity, they *simplify installation.*

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You can specify TUBE-TURN Welding Fittings and Flanges and know that you'll get the exact answer to your problem. The line includes all types in all piping materials, schedules and sizes. Also, Tube Turns offers you engineering assistance and helpful design literature.

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Tube Turns offers you outstanding distributor service . . . local stocks, geared for fast service. You can depend on this source for *all* your needs in welding fittings and flanges. One order . . . one source saves purchasing time.

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Welders are enthusiastic about TUBE-TURN products because they fit up true, and elbows can be cut to odd angles with perfect alignment. Rigid inspection and quality control by Tube Turns assures absolute dimensional accuracy and uniformity.

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Please send free copy of Pipe, Fitting and Flange Materials.

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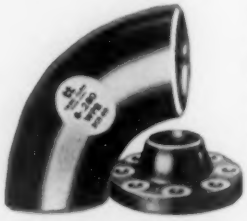

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A DIVISION OF NATIONAL CYLINDER GAS COMPANY

...your low-cost key to high octane

Atlantic's Catalytic Reforming Process continues to prove its ability in giving superior results on a broad variety of feed stocks. Catforming's simplicity brings savings through increased efficiency every step of the way—actually eliminating many profit-robbing intermediate steps.

Regardless of the volume of your charge stock, Catforming deserves your attention. One major reason that Catforming has "proved out" commercially is attributable to Atlantic's broad experience in all phases of petroleum refining and processing.

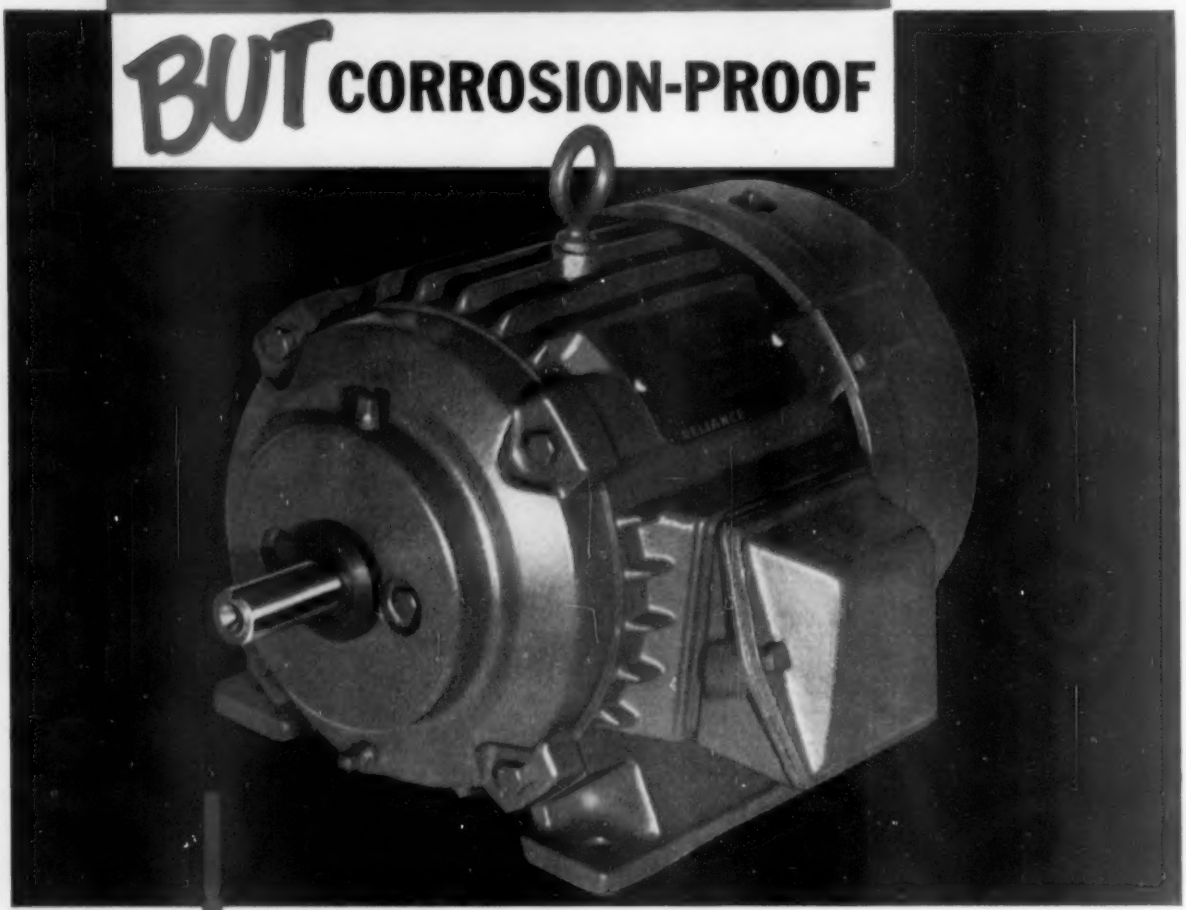
We invite your inquiries on Catforming. Write or wire The Atlantic Refining Company, Research and Development Dept., P.O. Box 8138, Philadelphia 1, Pa.

ATLANTIC

it's the CATALYST that counts

Not Just CORROSION-RESISTANT

BUT CORROSION-PROOF



Corrosion resistance is not enough to stop acids or alkalies from chewing up a motor in a hurry. That is why the wise engineer selects Reliance Corrosion-Proof Motors for corrosive service.

These motors are built to withstand the onslaught of destructive chemicals for years. Housings are made of virtually indestructible cast iron. Exterior contours are designed to slough off liquids—no nooks and crannies to retain corrosive elements. Enclosures are sealed to prevent any leakage . . . Metermatic lubrication systems provide complete protection against burned out bearings and contaminated lubricants.

Anyway you look at them, Reliance Corrosion-Proof Motors can take it—and you're not limited in the choice of motors either. A complete line of a-c. motors, 1 thru 300 hp., is available in all mountings, frequencies and voltages.

Why not call your Reliance representative today and get all the details.

B-1505

RELIANCE *Totally-Protected* MOTORS

RELIANCE ELECTRIC AND ENGINEERING CO.

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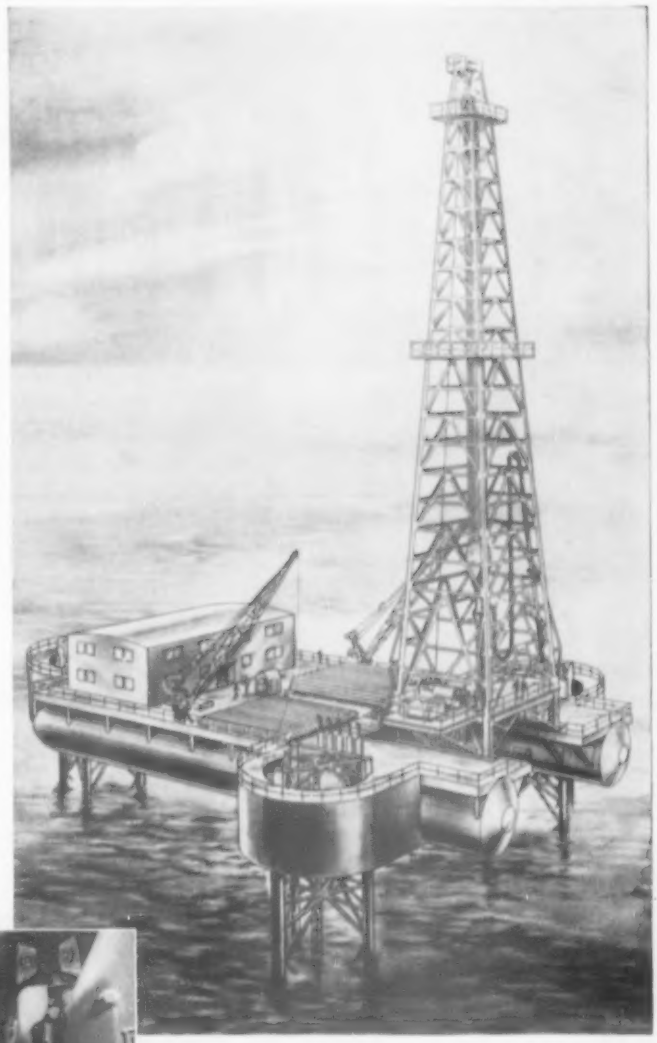
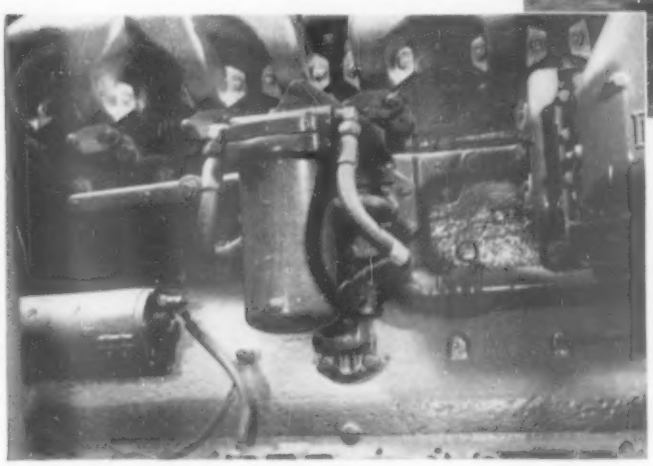
Sales Offices and Distributors in Principal Cities

Aeroquip Hose Lines Go to Sea with the New "Scorpion"

Newest off-shore drilling rig on the gulf coast is the 4000-ton "Scorpion" which is capable of raising itself to the height of a 10-story building. The ingenious platform was designed and built by R. G. LeTourneau, Inc. for Zapata Off-Shore Company.

Aeroquip Hose Lines are used to plumb the four diesel engines which supply power for raising and lowering the platform. Key factors in the selection of Aeroquip were the known dependability, and the ease of assembling hose and fittings which makes possible quick fluid line replacements from a minimum inventory of bulk stock.





Aboard the "Scorpion", Aeroquip Medium Pressure Hose Lines connect to a full flow filter on this Buda 8DAS-1125 supercharged engine.

Aeroquip offers hose line types for all kinds of stationary and mobile engines, hydraulic, air, and many other oil field applications. Your Aeroquip Distributor can give you complete information. Look him up in the Yellow Pages of Your Telephone Directory.

Aeroquip

REG. TRADEMARK

AEROQUIP CORPORATION, JACKSON, MICHIGAN

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Nothing left to

. . . with the new CUTLER-HAMMER

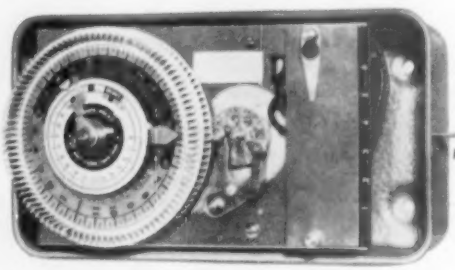
Cutler-Hammer has long set the pace in oil well pumping control. And now the *new*, brand new, Cutler-Hammer Three-Star Oil Well Pumping Control steps out *far* in advance of anything else offered. It leaves nothing to chance . . . to be so completely automatic and so completely dependable that it can be relied on to pump wells *indefinitely* without attention as far as the programming or electrical equipment is concerned.

The heart of the new Cutler-Hammer Three-Star Oil Well Pumping Control is the *new* Cutler-Hammer Supertimer. It not only provides the means for setting the desired pumping schedule (hours per day and days per week), but it provides for the *definite* sequence restarting of pumps after any power outage. There can be no uncertainty, no unfortunate coincidental restarting of even two pumps to cause overload troubles. Nothing left to chance!

This new control is not only protected against lightning; it also protects the motors against single-phasing which often results from lightning. It is designed for cool operation in the most blistering heat. Bugs, sand, rain or ice cannot enter the enclosure. The new Three-Star Control components have dust-safe vertical contacts which have been so improved that they will *never* require maintenance care or expense. Nothing left to chance!

Your nearby Authorized Cutler-Hammer Distributor is stocked and ready to serve you. Order from him today. CUTLER-HAMMER, Inc., 1453 St. Paul Avenue, Milwaukee 1, Wis. *Associate:* Canadian Cutler-Hammer, Ltd., Toronto, Ontario.

New Cutler-Hammer Supertimer



A. Sets restarting time delay accurately in 2.5 seconds increments from zero to 180 seconds.

B. Sets daily pumping schedule; 24 hours divided into 15 minute increments for timing of each day's pumping.

C. Sets weekly pumping schedule; control can provide pumping 1, 2, 3, 4, 5, 6 or 7 days per week as desired.

Member American CUTLER-HAMMER MOTOR CONTROL C-H *Petroleum Institute*

Chance...

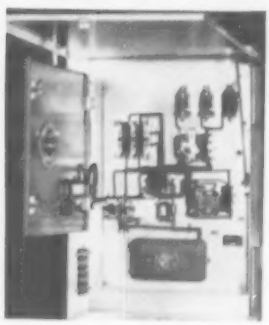
Three-Star Oil Well Pumping Control

Nothing left to Chance

The new Cutler-Hammer Supertimer not only controls the pumping schedule; it offers a selection of 73 restarting time delays in 2.5 seconds intervals from zero seconds to three minutes. This allows definitely timed sequence restarting of any numbers of pumps after any power interruption, avoids unfortunate coincidental restarts.

Nothing left to Chance

This new control provides full "dead-front" protection for pumpers. The disconnect switch can be thrown, the overload relays can be reset, the Supertimer dials can be adjusted, and test operation by manual control can all be accomplished without exposure to any live parts . . . an exclusive Cutler-Hammer feature.

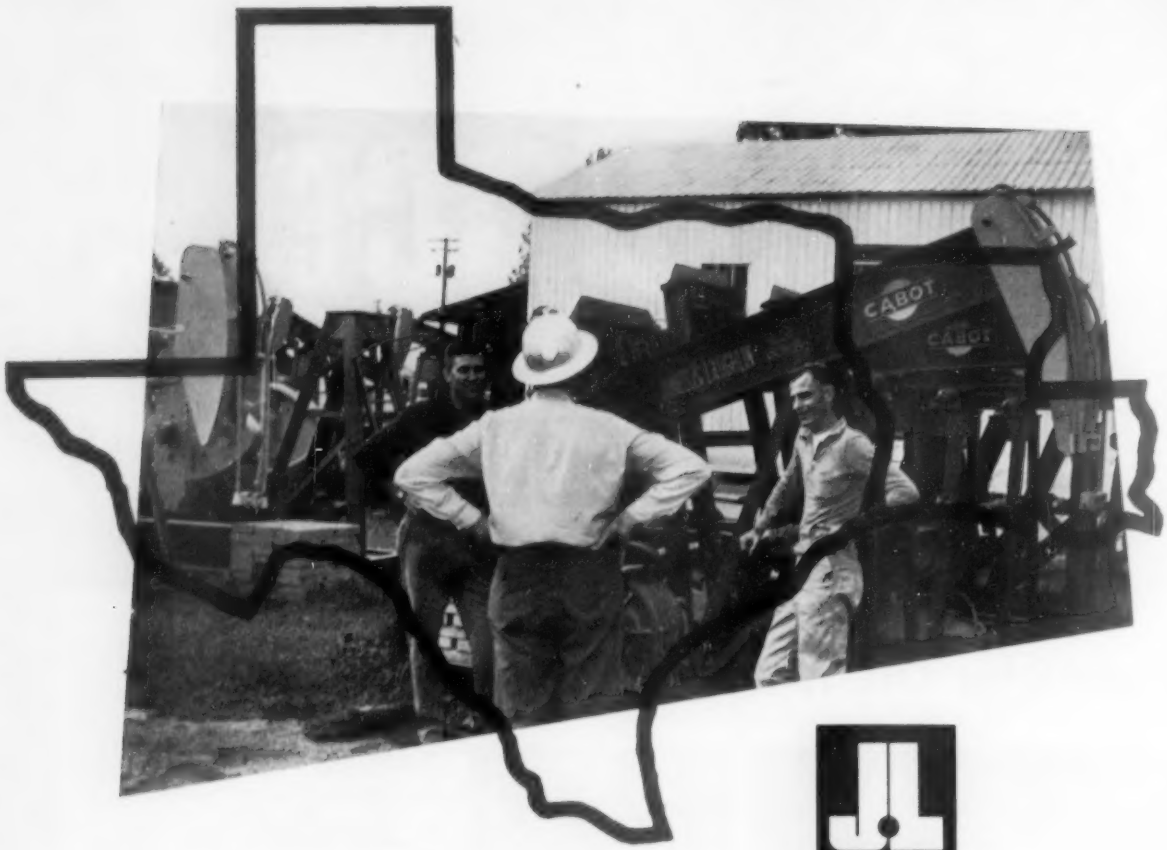


Nothing left to Chance

This new control provides dead-phase protection. Protection from circuit unbalance, which can also produce destructive motor heating, is obtained by the use of *three* overload relays in this "nothing left to chance" control.

Nothing left to Chance

Entirely new advanced-design power-line type lightning arresters in this new control not only provide more positive protection; they are arranged so it is impossible for anyone to inadvertently connect a lead for some special purpose in a manner which can destroy the protection afforded by the lightning arresters.



J&L
SUPPLY

Work can be a pleasure....

Men who drill wells and produce oil in Texas and Louisiana seem to have more fun than anybody.

If you have fun you have everything. Fun is contagious and makes for efficiency, as witness the fact that Texas and Louisiana drill 49% of the footage and produce 55% of United States oil!

In this Texas-Louisiana empire we have 39 stores and 9 offices. We have fun too—for fun IS contagious.

And fun DOES make for efficiency. Everywhere in the United States and Canada enthusiasm inherent in the oil business is a vital, driving force in J&L Supply service.

Yes, work can be a pleasure. Let's join forces! Get your J&L Supply store on the telephone.

- J&L Casing
- J&L Tubing
- J&L Drill Pipe
- J&L Wire Rope
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- Axelson Rods
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SUPPLY DIVISION – Tulsa

SERVING THE UNITED STATES AND CANADA

Lift Heavier Loads with no increase in rod size

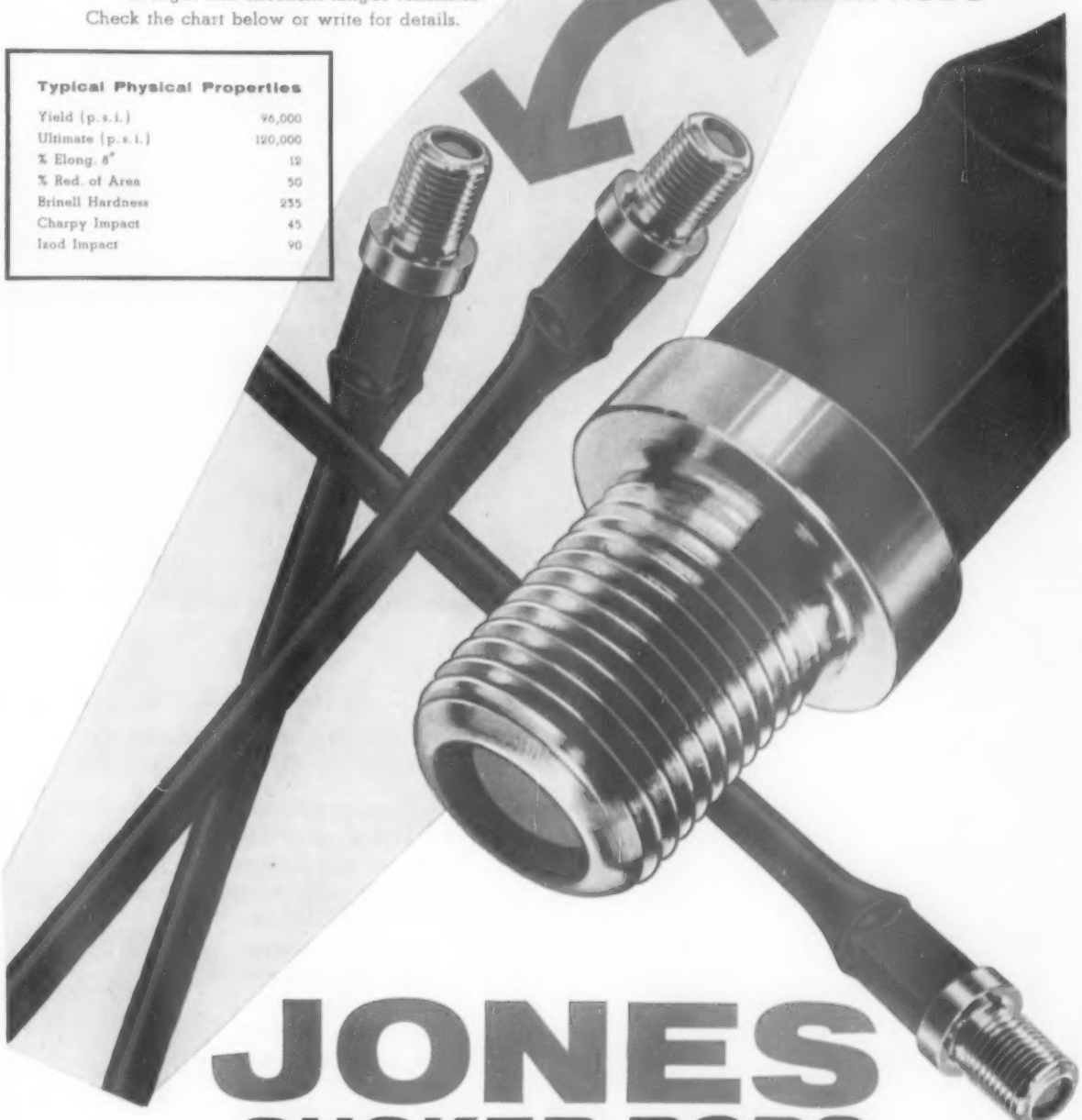
For the increased load of wells of 10,000 ft. or deeper, specify JONES TYPE 12 ROD.

Developed especially for this service, they are made from processed electric steel with exceptionally high yield strength and excellent fatigue resistance.

Check the chart below or write for details.

Typical Physical Properties	
Yield (p.s.i.)	96,000
Ultimate (p.s.i.)	120,000
% Elong. 8"	12
% Red. of Area	50
Brinell Hardness	235
Charpy Impact	45
Izod Impact	90

LOOK FOR THE GREEN RODS



JONES SUCKER RODS *last longer!*

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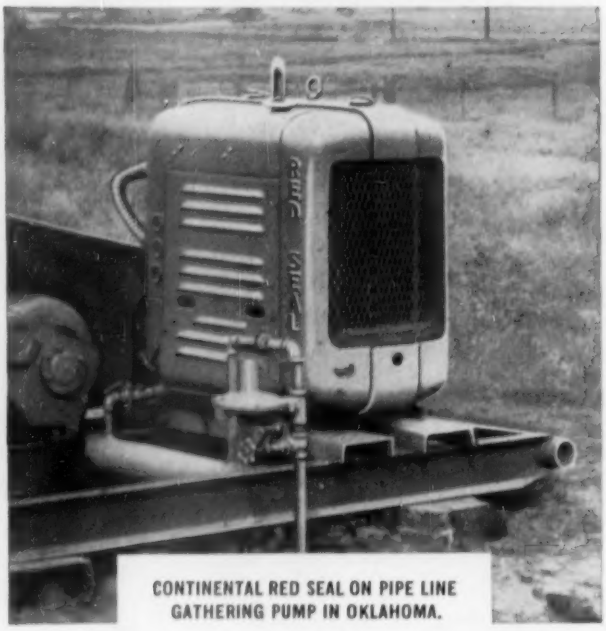
Export Sales Representatives: IDECO – Division of Dresser Equipment Company, Republic National Bank Building, Dallas, Texas and Chanin Building, New York City

YEAR-IN YEAR-OUT DEPENDABILITY



CONTINENTAL RED SEAL ON PIPE LINE GATHERING PUMP IN OKLAHOMA.

CONTINENTAL RED SEAL ON KOBE HYDRAULIC PUMPING UNIT IN TEXAS.

• • •

CONTINENTAL
RED SEAL POWER

One reason why you see so many of today's Red Seal engines in the oil fields is the fine performance record of those already on the job. Red Seals are engineered for reliability, economy and long life. They span a horsepower range from 10 to nearly 300. They're built for operation on all standard fuels. And they're backed by service and genuine Red Seal parts from coast to coast. Ask your oil field supply store, or write for information.

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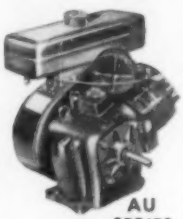
A COMPLETE LINE OF 4-CYCLE AIR-COOLED ENGINES FOR HEAVY-DUTY APPLICATIONS

Continental also builds small air-cooled engines, 2 to 3 hp., especially suitable for compressors, pumps, and other jobs where long-continued use with minimum attention is required. Automatic ignition cutoff stops engine when crankcase oil falls below safe operating level. Now available with built-in generator for charging battery and operating lights. For information, write Air-Cooled Industrial Engine Division, 12800 Kercheval Ave., Detroit 15, Mich.



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SINCLAIR REFINING COMPANY'S New Distillation Units By PARSONS

One of the largest installations of petroleum distillation capacity is scheduled to go on stream in June 1956 at the Sinclair Refinery in Marcus Hook, Pennsylvania.

Daily capacity of the crude units will be almost 150,000 barrels and that of the vacuum column will be 38,000 barrels.

Design, procurement, and construction are by PARSONS.

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Thoroughly experienced G & H towing crews . . . seasoned seamen who know and understand the treacherous wind and water currents offshore . . . take understandable pride in their skill at moving multi-million dollar drilling platforms such as Zapata Off-Shore Company's mobile structure "Scorpion." Pioneers in tidelands oil industry towing, this capable G & H marine experience pays dividends when spotting massive mobile equipment offshore.

THE EQUIPMENT:

Maneuvering platforms such as the 9,000,000 pound "Scorpion" presents no problem for the modern diesel-powered G & H tug boat fleet . . . one of the best equipped towing operations anywhere . . . with 19 seaworthy tug boats from the 700 hp class to the powerful new extra-heavy-duty 1700 hp "Grampus," which has joined the fleet offshore. Oil operators can count on this modern fleet, with its experienced operating crews, to safely and efficiently tow anything that floats . . . anytime, anywhere.

Call the G & H office nearest you today, and let us plan with you to solve your offshore towing problems. No obligation, of course.

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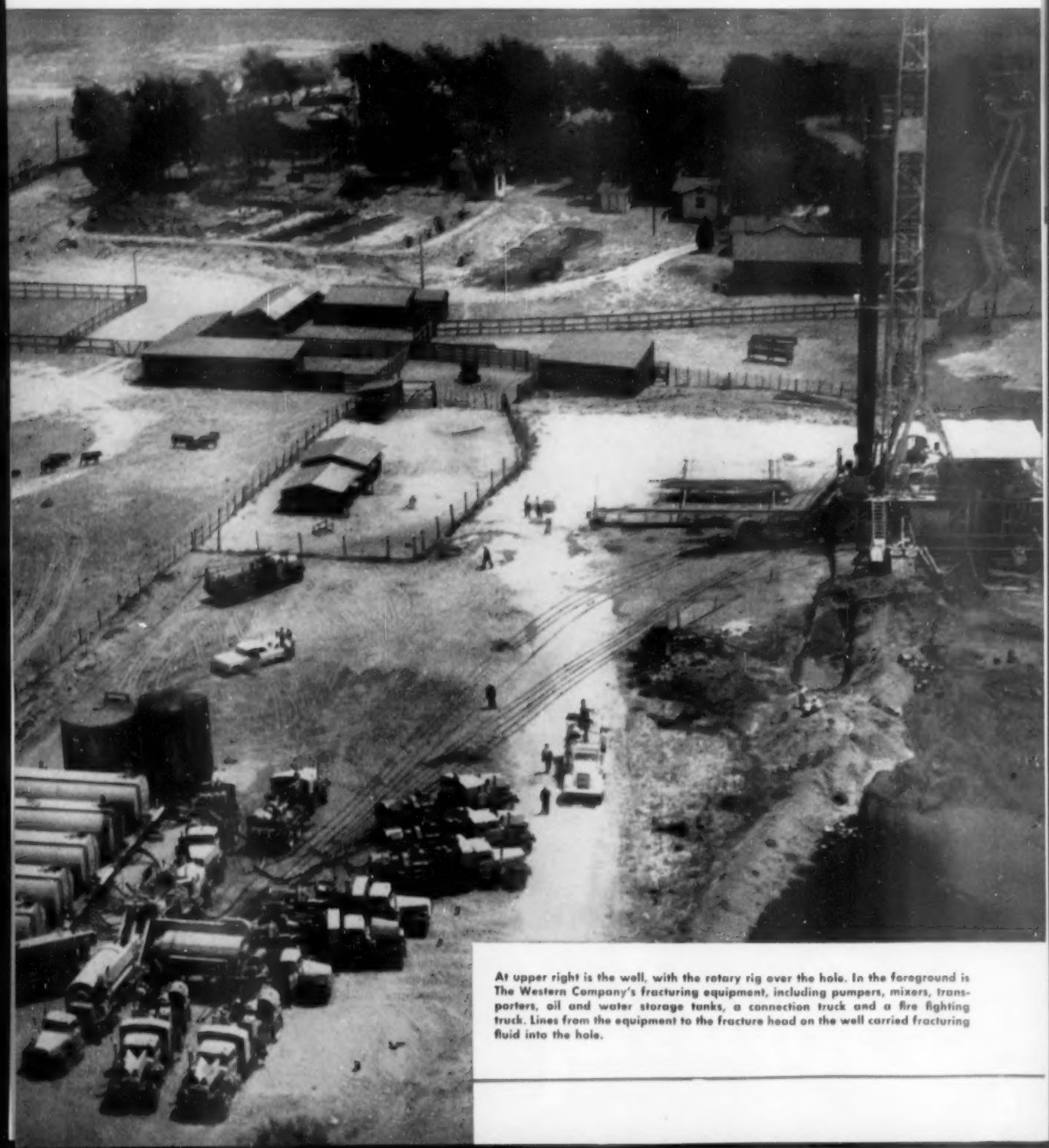
55 YEARS OF PROGRESS WITH THE OIL INDUSTRY

"Frac" job brings in Headlee
13,500 feet of NATIONAL



At upper right is the well, with the rotary rig over the hole. In the foreground is The Western Company's fracturing equipment, including pumpers, mixers, transporters, oil and water storage tanks, a connection truck and a fire fighting truck. Lines from the equipment to the fracture head on the well carried fracturing fluid into the hole.

Field Well as good producer

SEAMLESS CASING used

WHEN Southland Royalty Company's Roy Parks, Jr. No. 3, located in the Headlee Field of Midland County, refused to produce, Southland called in The Western Company, of Midland, to fracture the formation. Over a million dollars worth of surface equipment was assembled at the site to gain the desired injection rate in the deep well.

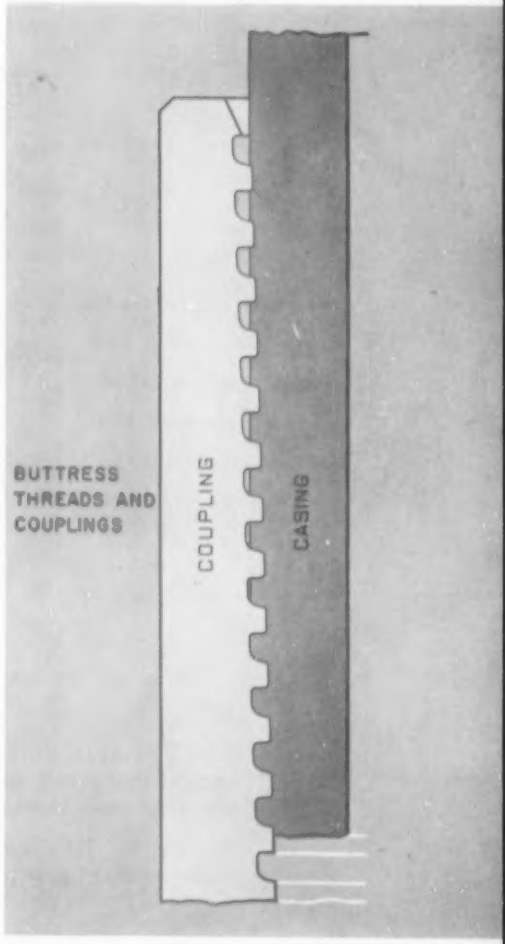
The well had been drilled to the Devonian, and NATIONAL *Deep-Well* and Buttress-Thread Casing had been run and perforated from 11,650 to 11,700 feet. Yet the well had made no commercial show of oil. The fracture treatment made the difference.

First, formation was broken down with crude oil at a pressure of 4800 pounds p.s.i. Then, 10,000 gallons of green oil, containing one pound of sand for each gallon, were pumped into the hole, followed by 290 barrels of flush oil. This stage of the treatment took just 19 minutes at an injection rate of 27.8 barrels per minute. Treating pressures averaged 5800 pounds p.s.i. Following stage one, an additional 38,000 gallons of oil and 18,000 pounds of sand were forced into the formation at a pressure of 6,000 p.s.i. Two days after treatment, the well potentialed 481 barrels of 48 gravity oil through one-fourth inch choke. Tubing pressure was 1700 lbs. and casing pressure was 200 lbs.

NATIONAL Seamless *Deep-Well* and Buttress-Thread Casing were especially developed for just such jobs as this. They possess the high collapse resistance needed to withstand the tremendous vibrations of deep well drilling, and in this instance the terrific stress of a high pressure frac job. The casing joints are designed to bear the weight of unbelievably long strings of casing. No wonder so many successful oil men inevitably say "NATIONAL SEAMLESS."

For full information on National Tube developments in the oil industry, write to National Tube Division, United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pa.

NATIONAL TUBE DIVISION
UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.
UNITED STATES STEEL EXPORT COMPANY, NEW YORK



The high tensile strength of the Buttress-Thread joint is due largely to the combined effect of the completely engaged runout threads and the three degree flank angle of the thread which support the weight of the casing in the well. The joint is comparable in strength to the body of the pipe. Buttress-Thread casing eliminates the need for upset-end casing—gives greater inside clearance for the drilling bit, and permits easier, faster coupling to power-tight position.

NATIONAL USS SEAMLESS

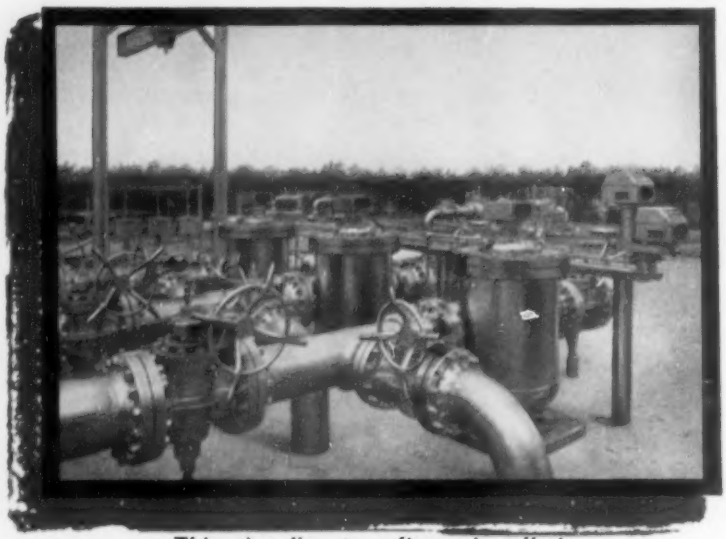
DRILL PIPE... CASING... TUBING

UNITED STATES STEEL

MECO Integrated SERVICE

SAVES TANKAGE

MECO'S engineering service teamed with advanced equipment result in profitable use of three 10" Smith crude oil meters with the total throughput of all meters combined to print a single ticket for the total tender.



This pipe line to refinery installation includes 4", 6" and 10" meters.

with SMITH METERS

SAVE TANKAGE. This battery of Smith positive displacement meters has saved the large expenditure necessary for tankage by allowing crude to flow directly to the stills.

HIGH % ACCURACY. Based on several years experience these meters have consistently maintained greater accuracy than obtained by the conventional tank gaging method.

LARGE VOLUME. 10" Smith meters in this installation have streamlined the handling of crude oil to this refinery, resulting in reduced evaporation losses and measurement costs.

For detailed information, write, wire or phone:

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Dallas, Texas
Shreveport, Louisiana

SUBSIDIARIES: Coastal Engineering Corporation*
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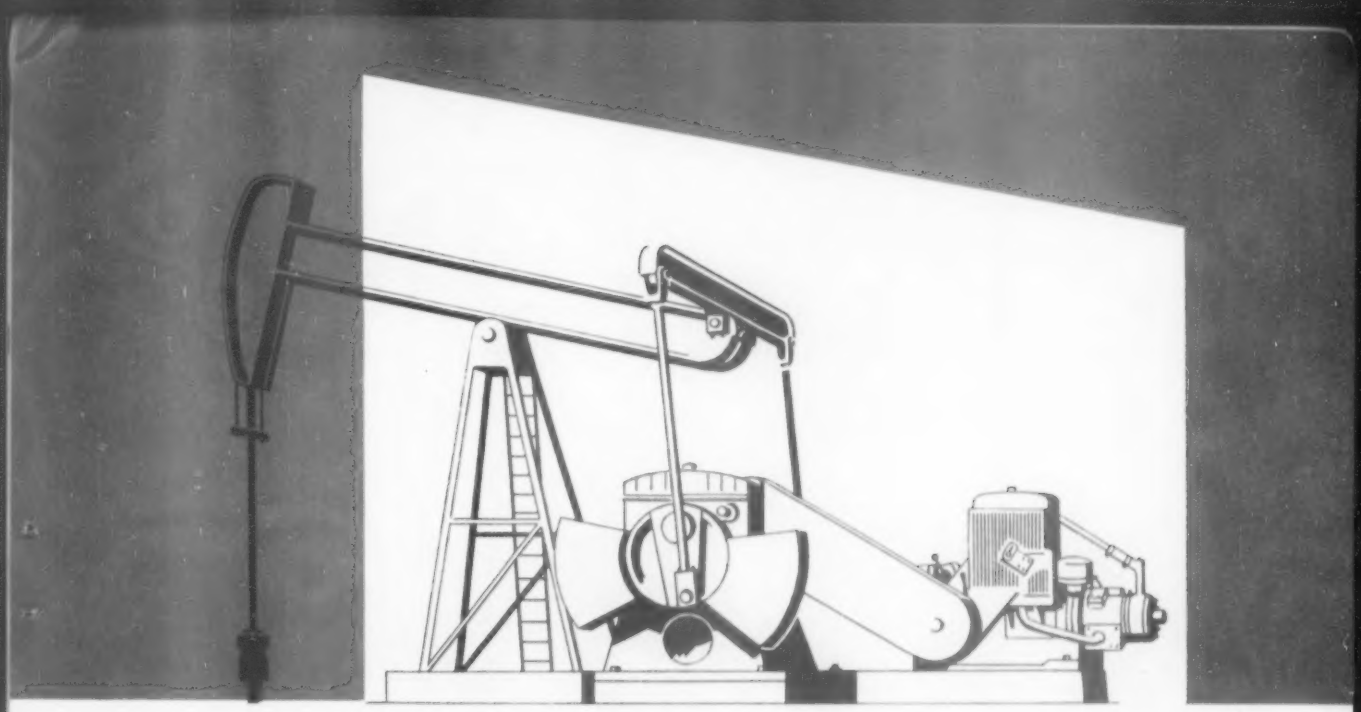
3711 CLINTON DRIVE — HOUSTON 20, TEXAS



HOW TO LOWER PRODUCTION COSTS:

Power your pumper

WITH *Ajax and Gas*

The fog of questions about rising production costs and narrowing profit margins can be swept away by a single sunlit fact: you can usually save half the cost of your engine each year with AJAX and gas! After two years, you have only negligible maintenance and fuel to pay for—from then on out, years of continued profit. More facts? Write us—see your Supply Man!

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CLARK BROS. CO., Olean, New York—Gas turbines, engines, and reciprocating, centrifugal and axial flow compressors — gas, steam, electric and diesel driven.

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DRESSER-IDECO COMPANY, Columbus, Ohio — Radio and television broadcasting towers, steel buildings, aircraft hangars, mechanical parking garages, electric power substations.

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electronic eyes and ears for industry

SIE — world's largest manufacturer of exploration seismograph equipment — serves as headquarters laboratory for the petroleum industry's geophysical organizations. Hundreds of SIE seismic systems are used by major oil companies and geophysical contractors to seek oil-bearing underground strata — a world-wide record of acceptance unmatched by any other company.

Southwestern Industrial Electronics has developed highly advanced electronic and electro-mechanical instrumentation for industrial automation, electronic computing instruments for measuring fluid and gas flow, data reduction equipment, and a wide range of electronic laboratory testing and recording instruments. Many SIE developments in electronics and automation are widely used in production and processing applications in many industries.

LANE WELLS

LANE-WELLS CO., Los Angeles, Calif., Houston, Tex., Oklahoma City, Okla.—Electric and Radioactivity Well Logging, Koneshot* perforating and bullet perforating, packers and bridging plugs.

SIE

SOUTHWESTERN INDUSTRIAL ELECTRONICS, Houston, Tex.—Seismograph systems and instruments—electronic, electro-mechanical. Computers—analog and digital; recording systems. Special transformers, reactors.

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another dimension to the DRESSER *plus+*

SIE The newest addition to the Dresser *plus+* family of independent – and integrated – companies is SIE . . . Southwestern Industrial Electronics. The many SIE seismic systems in operation today have made significant contributions to the petroleum industry's remarkable record of finding new reserves of oil and gas. Coupled with this, SIE's recent developments in the new field of automation provide an equally important contribution to industry in general.

As geophysical activity has increased and become more effective, SIE has paced the industry by developing new equipment and methods. Today SIE seismic systems, magnetic recording systems, geophones, recording oscillographs, precision galvanometers, radios and other electronic instruments are serving the oil industry in every major field in the world. SIE adds electronic instrumentation to the broad application of Dresser *plus+* equipment and services.

The unique teamwork offered by Dresser companies covers every phase of the oil, gas, chemical and electronic industries . . . and combines to make the Dresser *plus+* a symbol of superior products and services that are the standard of comparison throughout the world.

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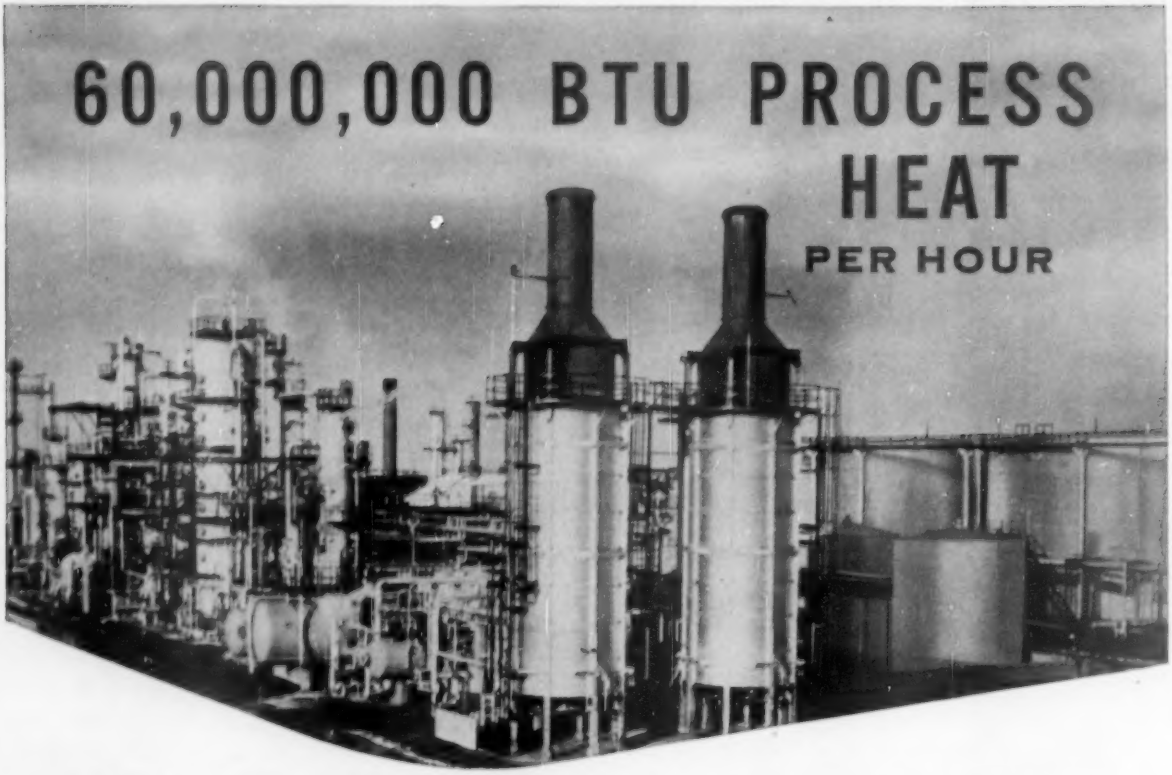

A typical Struthers Wells CIRCULATING HEATING SYSTEM serving a major Canadian oil refinery

The Dowtherm heaters shown above are installed in the plant of a major Canadian oil refiner. The heaters are part of Struthers Wells circulating heating systems, utilizing liquid Dowtherm as the heating medium, at temperatures of approximately 700°F.

This equipment is used to supply process heat for reboilers and other heat transfer equipment, as installed in a modern lubricating oil refining operation. This type of equipment insures close temperature control and high heat transfer rates in the users. The capacity of these systems is 60,000,000 BTU per hour, making it one of the largest installations of this type.

Struthers Wells is a major supplier of circulating heating systems for both liquid and vapor service, and utilizing commercial heat transfer fluids in a wide temperature range. Hundreds of successful installations, many of them repeat orders, provide a wide background on which to base recommendations for any type of service.

Fired heaters for the direct heating of process fluids, as gas, steam, and hydrocarbons, to the highest commercial temperature ranges are also built by Struthers Wells.

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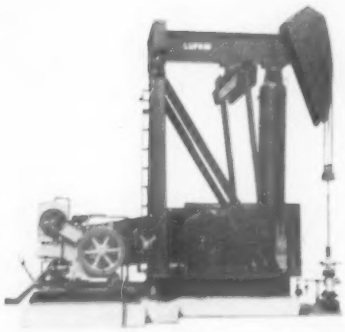
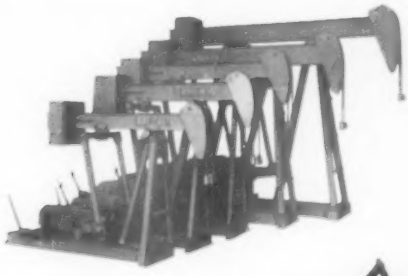


A AIR BALANCED UNITS

For compactness, light weight and ease of installation. Available in sizes ranging from 80,000 in. lbs. peak torque and 19,000 lbs. polished rod capacity to the mighty A-912DA-192-42 with 912,000 in. lbs. peak torque, 192 inch stroke and 42,000 lbs. polished rod capacity.



B BEAM BALANCED UNITS

Where economy is an important factor and dependability a prime consideration. Sizes from the B-10D-20-4 with 10,000 in. lbs. peak torque and 4,000 lbs. polished rod capacity to the B-57D-42-10.5A with 57,000 lbs. peak torque and 10,500 lbs. polished rod capacity.

C CRANK BALANCED UNITS

The all purpose unit known the world over for its ruggedness, trouble-free performance, and low cost maintenance. Sizes from the C-25D-24-6 with 25,000 in. lbs. peak torque and 6,000 lbs. polished rod capacity to the C-912DA-168-30 with 912,000 in. lbs. peak torque and 30,000 lbs. polished rod capacity.

Plus... LONG STROKE HYDRAULIC UNITS

For deeper wells ana heavier fluid loads where high rod stresses are encountered. Rod life is greatly increased by this unit's slow, cushioned reversals and uniform polished rod velocity which avoids high peak loads. Available in 35,000 lbs. polished rod capacity and 20 ft., 25 ft., and 30 ft. stroke lengths.

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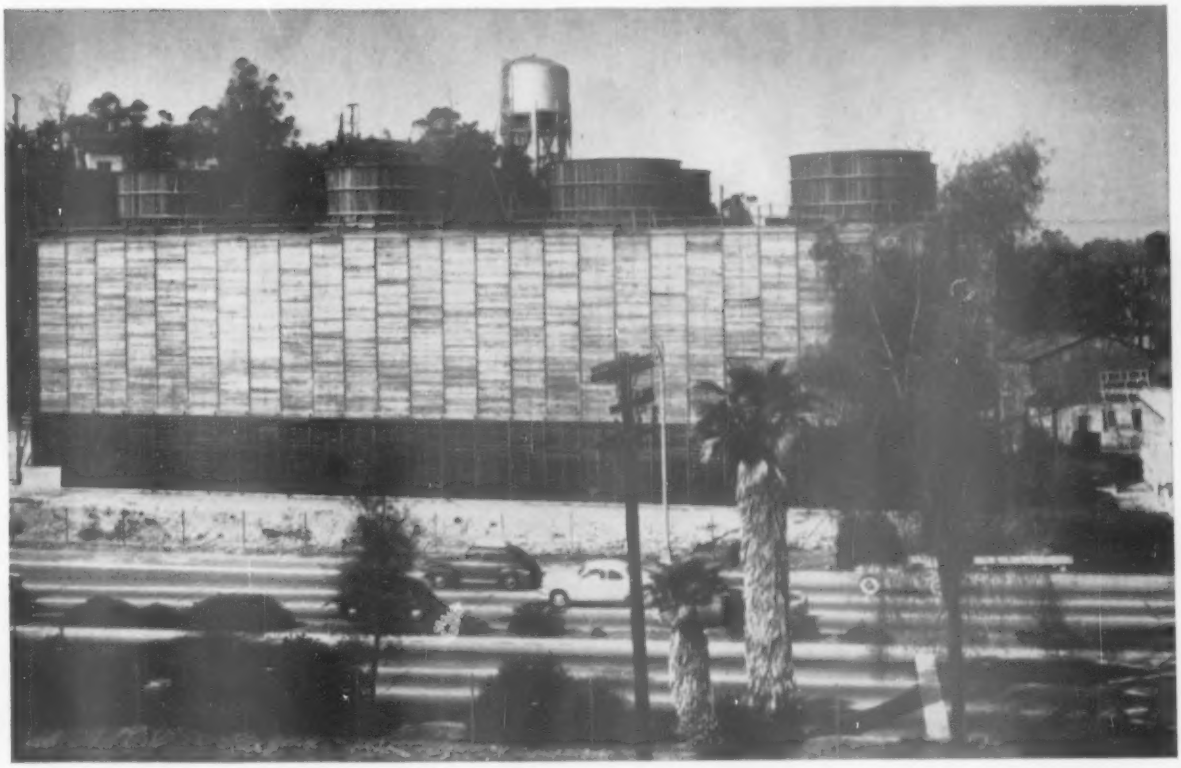
COOLING TOWER
Eliminates Highway Fogging Problem



Careful Custom-Engineered Design eliminates driving hazard on one of Southern California's main traffic arteries

THE Municipal Light and Power Department of the City of Pasadena, California, faced a serious problem in locating cooling towers within 25 feet of the Arroyo Seco Freeway at their Broadway Steam Plant.

Although the vapors from a cooling tower contain nothing but pure water and do not *pollute* the atmosphere, "fogging" of the Freeway could not be tolerated as a driving hazard.

The Foster Wheeler eight-cell cooling tower shown above, installed in 1954, has successfully met this challenge. Freedom from "fogging" of the Freeway was achieved by proper drift-eliminator design, correctly engineered exit vapor velocities, and the use of *moderately* high fan stacks extending 12 ft. above the fan deck and 55 ft. above the basin curb.

Complete satisfaction with this initial FW Cooling Tower has now been proved by the City's recent re-order of a duplicate FW Tower to be located down the property line adjacent to the Freeway.

THIS NEW BULLETIN describes the *new* Foster Wheeler induced-draft, counter-flow cooling tower — every detail designed for long-range dependability and economy. Send for your copy today. *Foster Wheeler Corporation, 165 Broadway, New York 6, N. Y.*

FOSTER WHEELER

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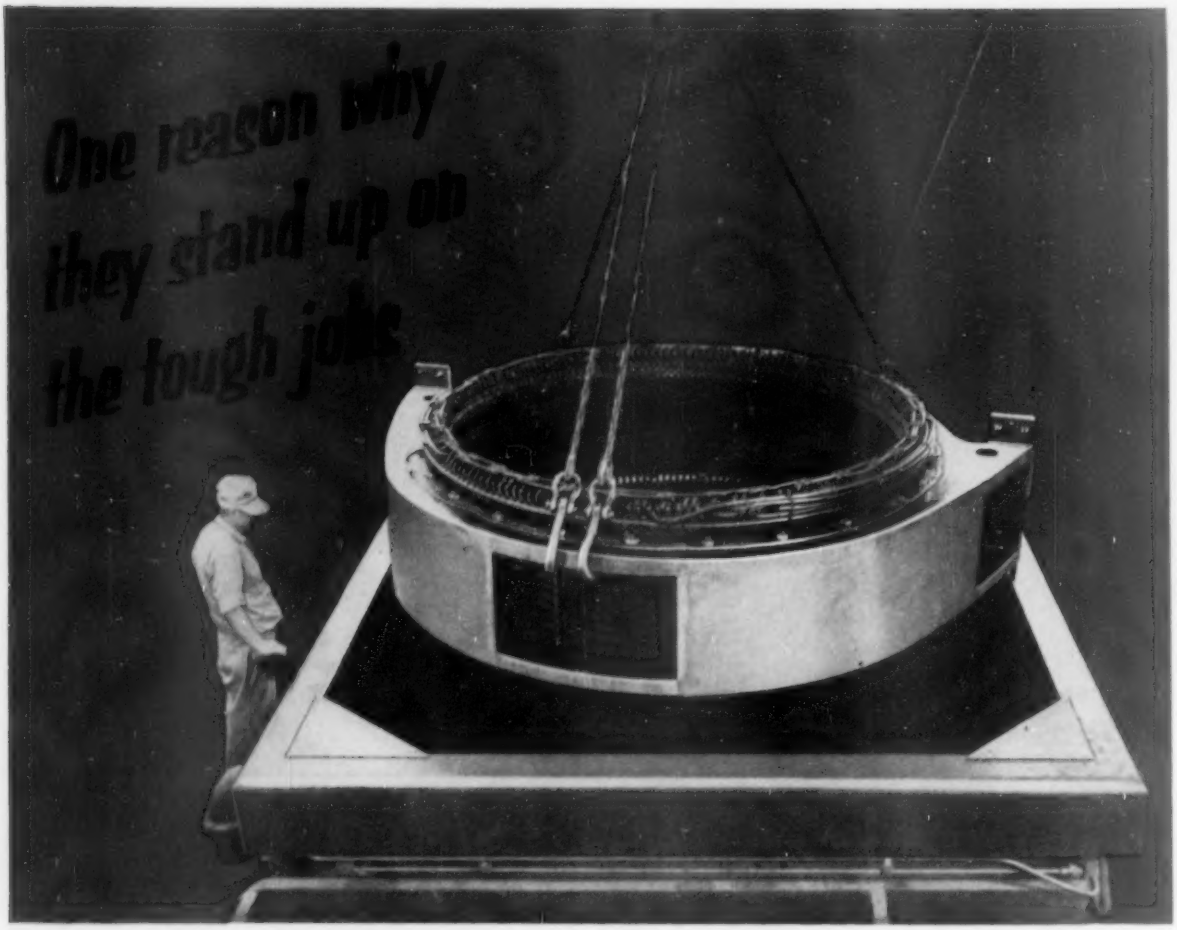
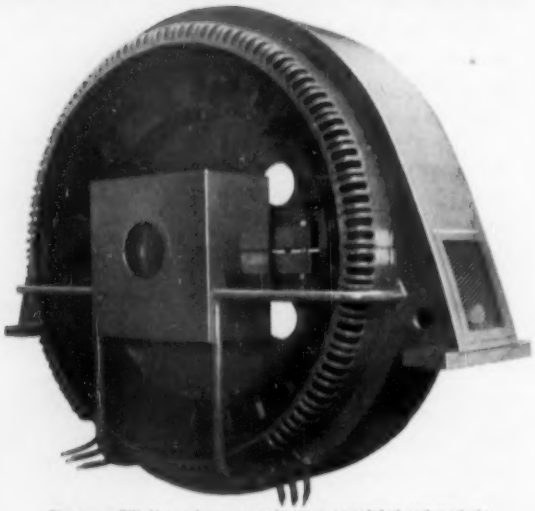


ELLIOTT SYNCHRONOUS MOTORS



The same Elliott synchronous motor now completed and ready to be shipped to a northeastern chemical plant where it will drive a compressor. Motor is rated at 3500 hp and 300 rpm and has an enclosure over collector assembly for pressure ventilation.

RG-15

A COMPLETE STATOR DIP IN THE INDUSTRY'S LARGEST INSULATING VARNISH TANK is an essential step in the special painstaking coil insulation process for synchronous motors that operate in paper mills, chemical plants, power stations and rubber mills where severe moisture, chemical fumes, abrasive or conducting dust conditions prevail. Unlike the usual spray method of varnish application, complete penetration and coverage is assured by complete immersion. After baking, the coil ends are given two additional dips and bakes to further protect against the entrance of moisture, chemical fumes, dust, etc. Better coil insulation is one of a number of "extras" that help make Elliott synchronous motors first choice for compressor, ball mill, rolling mill, pulp grinder, and many other tough service drives.

Ask your Elliott field engineer for details or write Elliott Company, Ridgway Division, Ridgway, Pa.

ELLIOTT Company

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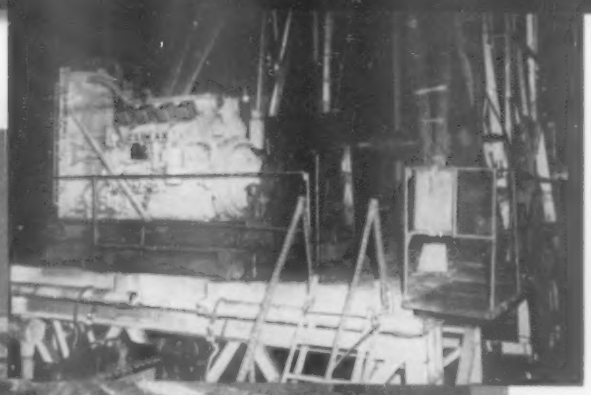

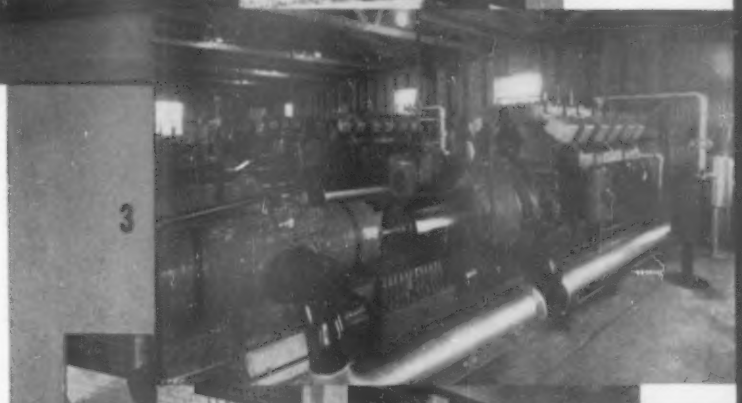

POWER PROBLEMS?

NOT HERE!

Climax Blue Streak Engines can solve your power problems anywhere in the oil country. These pictures show Climax Blue Streak Engines on a variety of jobs . . . (1.) a V-60 power unit on a Texas drilling rig, (2.) a Climax R-165 powering an irrigation pump in Utah, (3.) a gas compressor installation on the Gulf Coast using three Climax V-12's to drive rotary gas compressors, (4.) a Climax V-125 installed in a California city's water system driving a pump through a right angle drive, and (5.) three Climax V-125 sewage gas engines driving 5060 cubic feet blowers, on the eastern seaboard. For each of these installations . . . and many hundreds more . . . dependable, rugged, economical, Climax Blue Streak Engines were chosen because they deliver the power when you need it, where you need it, and as long as you need it. Intermittent operation or 24 hours a day — constant full power use or rapid acceleration, Climax Blue Streak Engines always deliver.

For any power problem call your nearby Climax distributor.

Climax BLUE STREAK ENGINES

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why STAINLESS STEEL TUBING?

Selection of the proper grade of stainless steel tubing is essential because no single metal or alloy economically resists all corrosive conditions. As certain physical properties are required for specific applications, sometimes the consideration of corrosion resistance is neglected when the choice of tubing material is made. For example, if a degree of corrosion resistance can be imparted to ordinary steel by the use of a protective coating, and if replacement cost of the article is low, this may be the sensible course.

But where replacement cost is high, or where contamination through corrosion may occur, the wisest, and in the long run the most economical choice of tubing, is a stainless steel of the correct analysis for the conditions of manufacture and service.

Get in touch with Mr. Tubes, your link to B&W, for a detailed comparison of grades suitable for your use and learn how to get more for your money with stainless. *Or write for Bulletin TDC-160.*

B&W
TUBULAR PRODUCTS DIVISION

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TUBULAR PRODUCTS DIVISION
Beaver Falls, Pa. and Milwaukee, Wis.: Seamless Tubing, Welded Stainless Steel Tubing
Alliance, Ohio: Welded Carbon Steel Tubing
Milwaukee, Wis.: Seamless Welding Fittings

TA-5037(P)

Coolidge, Casa Grande, & Marana, Ariz. Lafayette, La. El Paso, Texas Salt Lake City, Utah

A Smoother Roll Out with Eastman CASING ROLLERS

The most rugged, efficient, effective, and economical tool devised for rolling out casing and liners to their original gauge.

Eastman Casing Rollers are constructed of heat treated steel. Multiple rollers create a smooth rolling action that opens the casing without splitting.

For many years Eastman Casing Rollers have been available in API sizes ranging from 3½" to 17⅜" —

... AND NOW ... A NEW 22" CASING ROLLER IS AVAILABLE FOR ROLLING OUT CONDUCTOR CASING.

For service – call the Eastman office nearest you.

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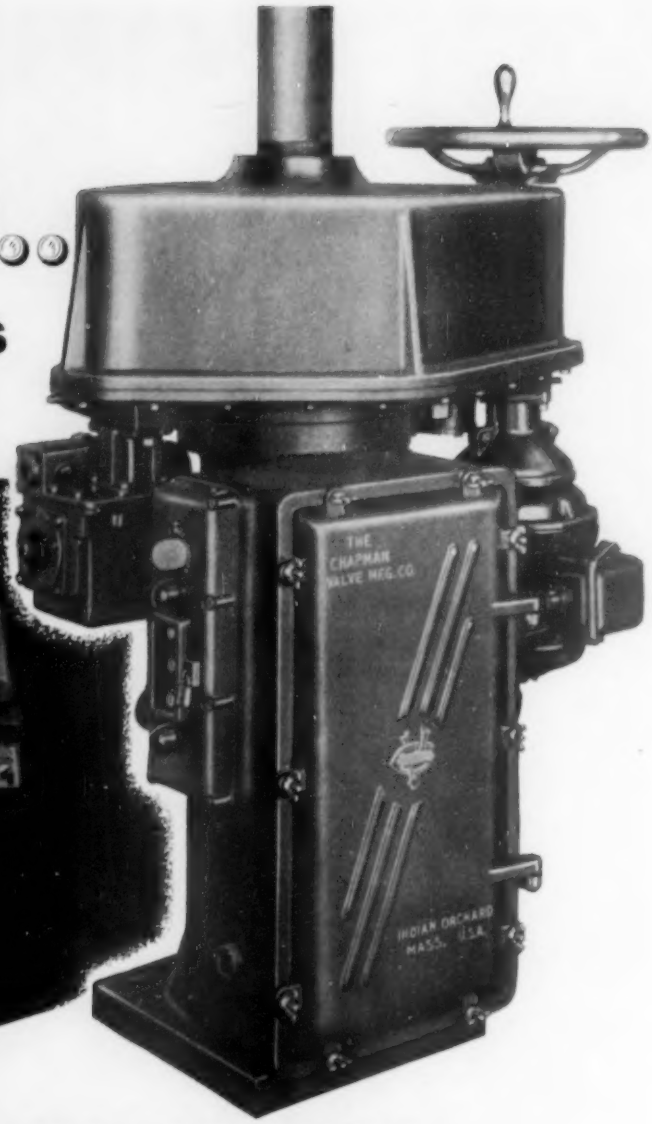


CHAPMAN MOTOR UNITS

Just look at them . . . inside as well as out. You'll find that Chapman Motor Units are not only rugged in construction, *they're simple in design.* In fact, a Chapman Motor Unit has approximately *half as many parts* as any other unit.

This simplicity means better, easier operation and lower maintenance costs. It means longer life with fewer repairs.

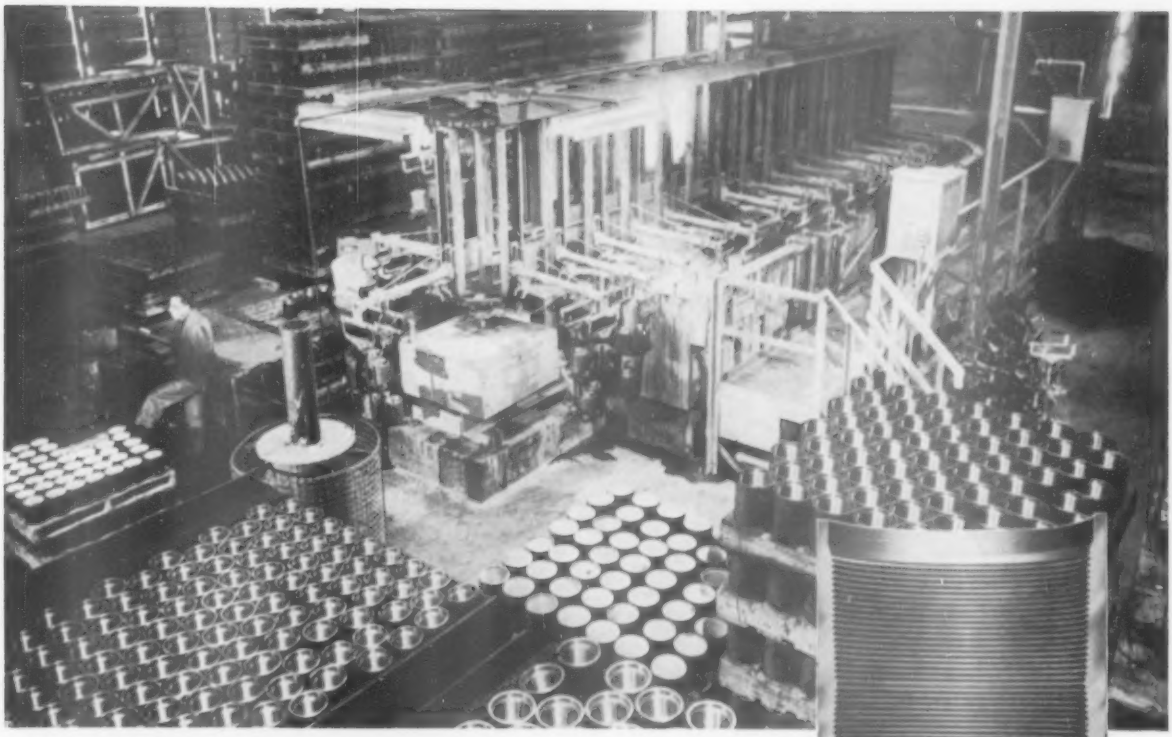
With Chapman Motor Units your valves seat tight . . . but never too tight. Micrometer adjustment on limit switch insures exact tightness presetting. Drift is eliminated. Lash is slashed. Complete operation by low speed motors is always smooth, accurate and trouble free.

Use them in any position. Quiet, rugged stub-tooth gears require no grease or oil. Use them under the most adverse conditions. They're weatherproof, steamtight, dependable.

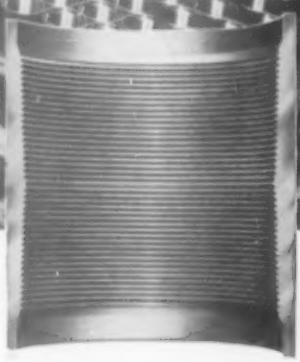
Installation is quick and easy. Chapman Motor Units and Floorstands are wired and ready to tie in with your leads. Just hitch them up. You're in business.

Get the whole interesting story in our newest catalog 51. Write for it, your copy, now.

The CHAPMAN VALVE Mfg. Co.
INDIAN ORCHARD, MASS.



Continuous electrogalvanizing unit for CF&I Seamless Couplings.



Cross section photograph of actual CF&I Seamless Coupling.

CF&I QUALITY COUPLINGS FOR SEAMLESS CASING AND TUBING

Rigid manufacturing standards, testing and re-testing are typical of the care CF&I exercises from mine through manufacture. These manufacturing standards assure Seamless Tubular Products of the highest quality.

The stresses imposed on oil country tubing and casing joints demand exacting manufacturing controls. One requirement in obtaining quality joints is to have a tight seal between the coupling and the pipe. This can be obtained only if the couplings and pipe are manufactured under the strictest specifications.

API Specifications require that all couplings must be processed to minimize galling. CF&I electrogalvanizes all couplings and exceeds this specification by carefully controlling the exact thickness of pure zinc—just enough zinc to prevent galling, but not enough to fill in the threads. This is just one example of the extra care which CF&I takes in the manufacturing process of their Seamless Tubular Products.

CF&I Seamless Oil Country Casing and Tubing meets API STD 5A Specifications—in sizes from 2⅜" O.D. through 9⅝" O.D.

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Denver, Colorado

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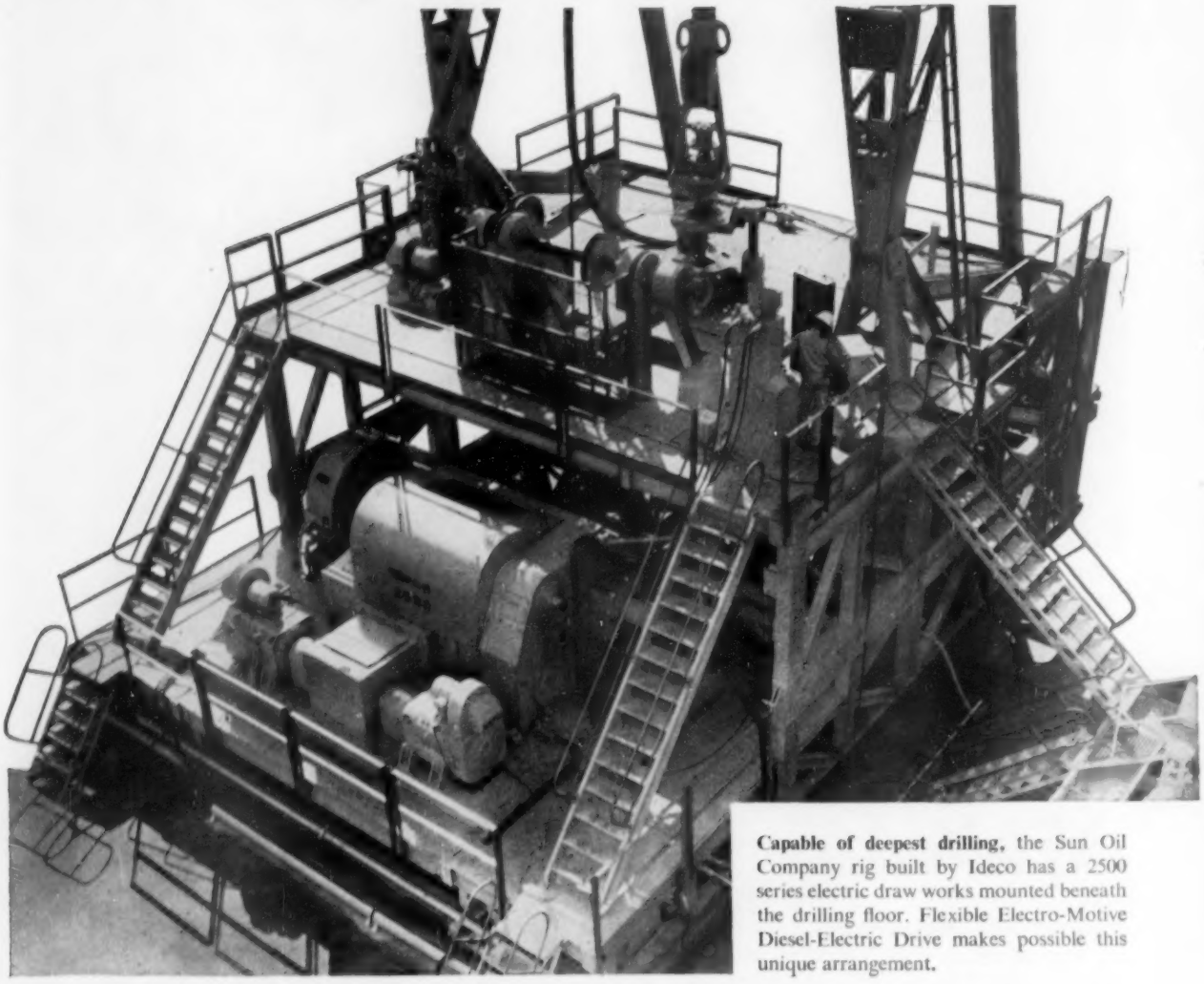
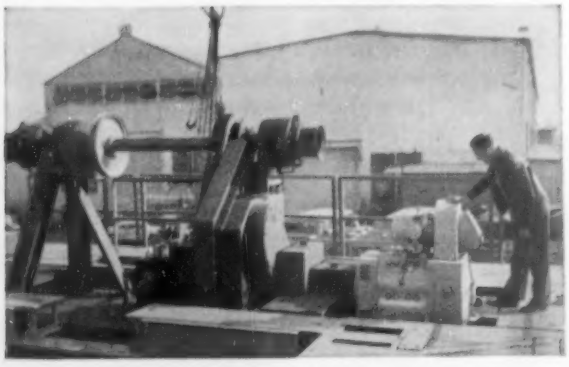
It's the cleanest, most



Capable of deepest drilling, the Sun Oil Company rig built by Ideco has a 2500 series electric draw works mounted beneath the drilling floor. Flexible Electro-Motive Diesel-Electric Drive makes possible this unique arrangement.

B. H. Hefner, Chief Electrical Engineer of Electro-Motive Division (center), discusses application of GM Diesel-Electric Drive with "Buck" Wilder of Sun Oil Company (left) and W. O. Cook, Vice-President of Ideco.



Newell B. Collins, Electro-Motive Service Engineer, inspects arrangement of drilling platform, where only one motor is mounted to drive rotary table and cathead.

flexible rig in sight

Sun Oil Company's new Ideco rig with Electro-Motive Diesel-Electric Drive takes the draw works off the drilling floor

Innovation in deep-well drilling rigs is the new unit built for Sun Oil Company by Ideco, one of the Dresser Industries, at its plant in Beaumont, Texas.

Powered by a pair of Electro-Motive SR-8 Diesel-Electric generator sets driving 7 motors, this revolutionary rig offers entirely new standards of flexibility, efficiency and economy.

Only one motor, powering the rotary table and cathead, is mounted on the platform. The Ideco 2500 series electric draw works is located beneath. This design avoids clutter, saves space and makes the rig easier and more economical to move.

Electro-Motive Drilling Rig Power Plants can be used with *any* drilling equipment operating today. The motors driving draw works, rotary table and mud pumps are connected by flexible cable to the generating units—and the connections can be made by anyone with a simple understanding of house lighting.

But to make doubly sure the equipment is properly used, we instruct your people both on the job and at our Factory Training Center in La Grange.

For further information about this moneysaving Diesel-Electric power, call your nearest Electro-Motive Representative.

Features of Electro-Motive Drilling Rig Power

Completely Integrated Design—Each of the major components designed and built to work together—*one* manufacturer—*one* source of service responsibility.

Maximum Portability—All components on skids with weight reduced to a minimum. Units are ruggedly built to withstand handling. No position problem—slashes setup and moving time on land rigs.

Unmatched Flexibility—At a flick of the selector switch on the driller's control panel, power can be selected from one or more generators to meet any power requirement.

Simplified Control—Centralized position of all controls for driller's convenience—continuously variable draw works speed control and complete rotary table torque control at the driller's finger tips.

Lower Drilling Costs—Lower first cost and lower cost per well drilled. Smooth electric power—flexible control—means less down time, speeds drilling.

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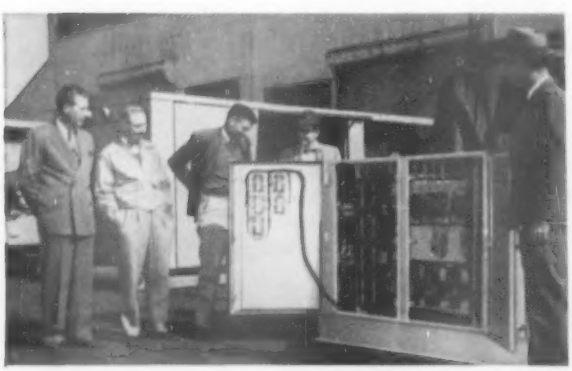
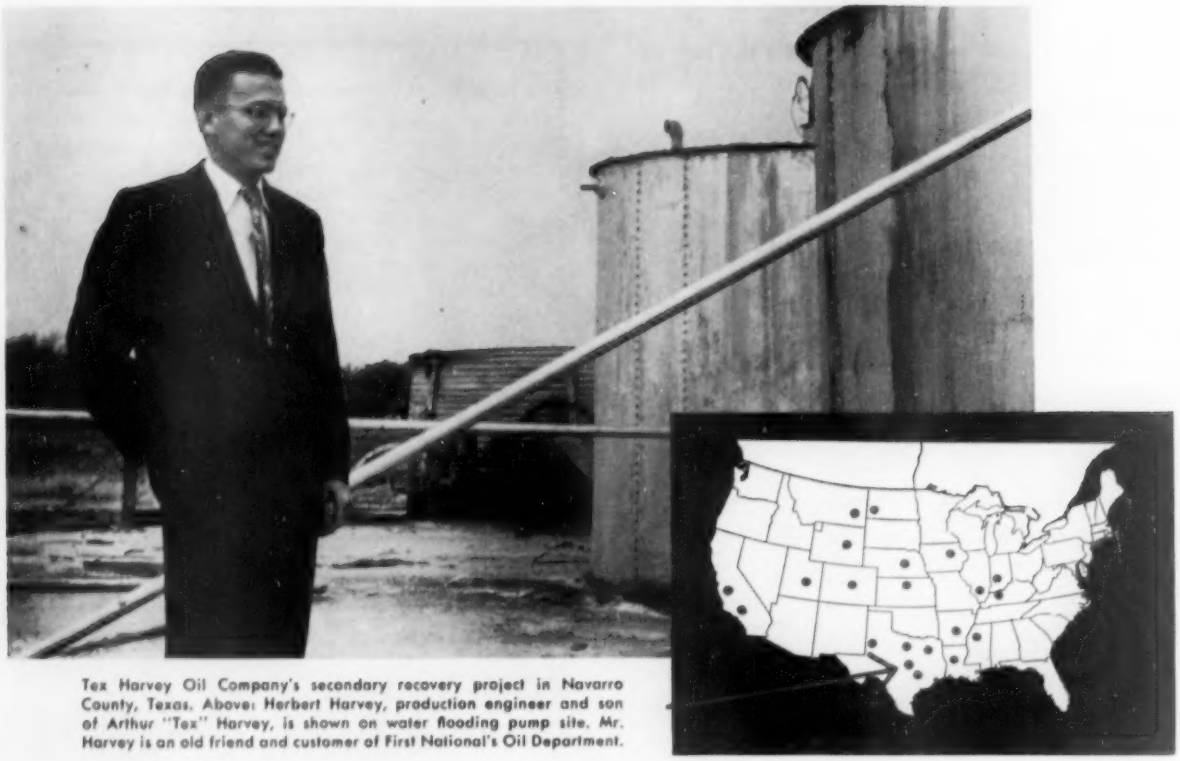


Compact electrical control cabinet utilizes proved components of General Motors Diesel-Electric locomotives. In photo are W. O. Cook, Bert Hefner, Bill Withers, Sun Oil Company, "Buck" Wilder, Sun Oil Company, and A. R. McLerran, Ideco.

Driller's control stand is located on corner of the floor. Control panel carries selector switch, engine speed, mud pump, hoist and rotary table controls, as well as warning lights and safety switches.

Financing from the **FIRST** *in Dallas goes where you go!*



Tex Harvey Oil Company's secondary recovery project in Navarro County, Texas. Above: Herbert Harvey, production engineer and son of Arthur "Tex" Harvey, is shown on water flooding pump site. Mr. Harvey is an old friend and customer of First National's Oil Department.

- Straight collateral loans on oil or gas producing properties, secondary recovery, refining plants, pipe lines and progressive loans.
- Oil and gas payment loans.

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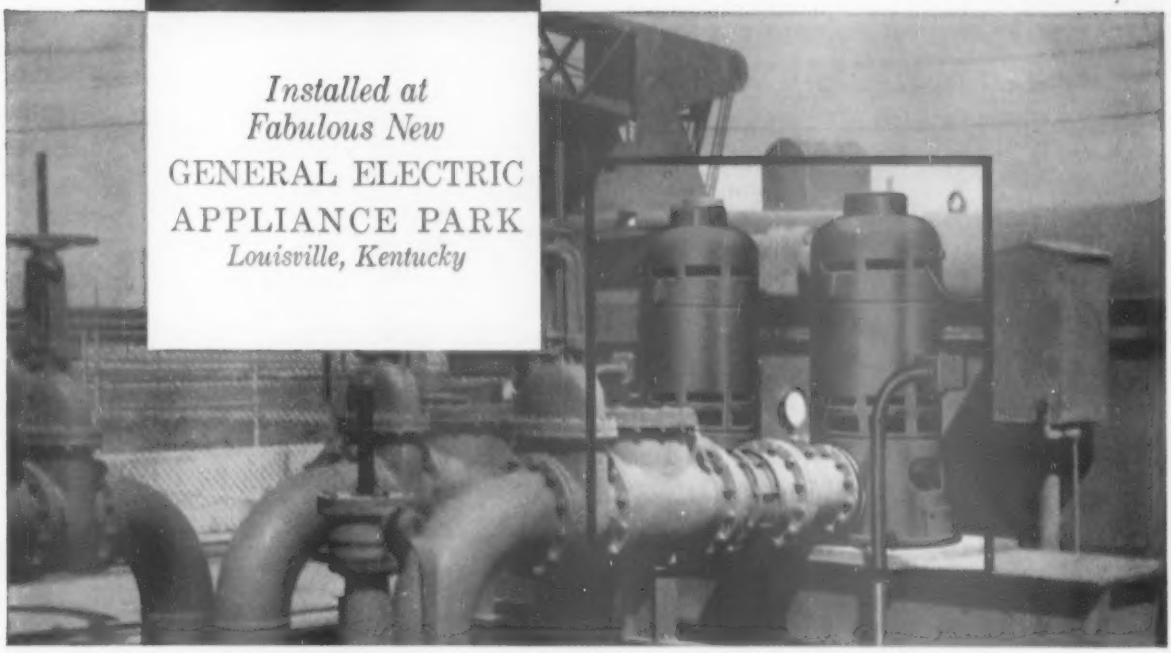

Comprising a complete industrial city, the new General Electric Appliance Park at Louisville, Kentucky, housed in five huge buildings (another under construction), is nearly a mile wide and a mile and one-half long.

Two Johnston Vertical Turbine Pumps have been installed outdoors on the roof of the mill pond house. Their function is to take water from the mill pond and circulate it through the spray nozzles for cooling purposes, and to provide circulation for the mill pond. These pumps were installed by Johnston's representative Diehl Pump and Supply Co., Inc. of Louisville, Kentucky.

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PUMP COMPANY
Founded in 1909
Bin "K", Pasadena 15, California

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VERTICAL PUMPS

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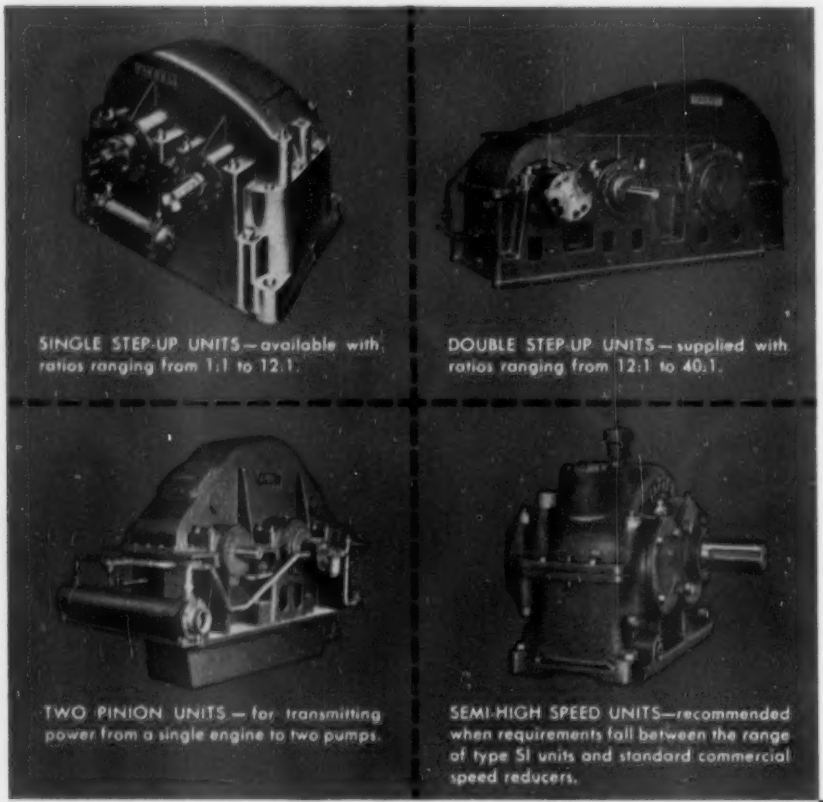
Farrel has the right SPEED INCREASER for the job...



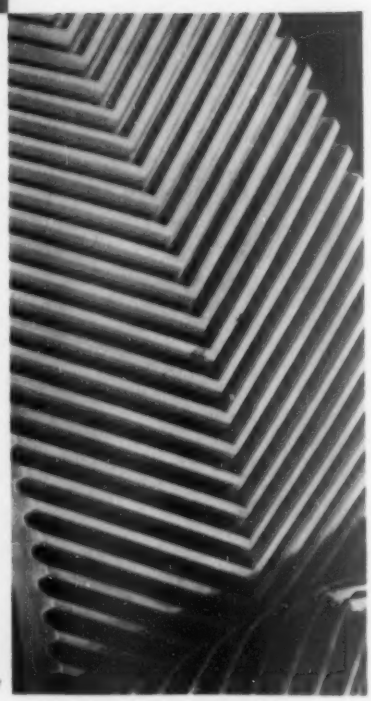
SINGLE STEP-UP UNITS—available with ratios ranging from 1:1 to 12:1.

DOUBLE STEP-UP UNITS—supplied with ratios ranging from 12:1 to 40:1.

TWO PINION UNITS—for transmitting power from a single engine to two pumps.

SEMI-HIGH SPEED UNITS—recommended when requirements fall between the range of type SI units and standard commercial speed reducers.

and backbone will keep it there



Besides matching a broad range of requirements for ratio, horsepower, loading conditions and similar factors, Farrel speed increasers offer the benefit of *backbone*. Formed where the teeth of the gears meet without a center groove, *backbone* puts the *full* face width of each gear to work. Benefit: Extra strength and staying power—important where service continuity is a must.

Proof of this dependability is on record. Since 1932, when Farrel SI units were first put into service, not one has ever had to be replaced.

Next time you're faced with a speed increasing problem, take it to Farrel. In the meantime, send for a copy of bulletin 448A. No obligation.

FARREL-BIRMINGHAM COMPANY, INC., ANSONIA, CONN.

Plants: Ansonia and Derby, Conn., Buffalo and Rochester, N. Y.
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Panning returned cuttings before laboratory study is an important part of Baroid's Mud and Cutting Analysis Well Logging, which gives you complete information on your well while the bit is making hole. These tests supplement the continuous drilling mud analysis recorded in the Baroid logging truck.

Baroid's exclusive new Higher Hydrocarbon Adsorber and Hydrogen Reactor eliminate false gas shows caused by oil emulsion mud or by drill pipe corrosion.

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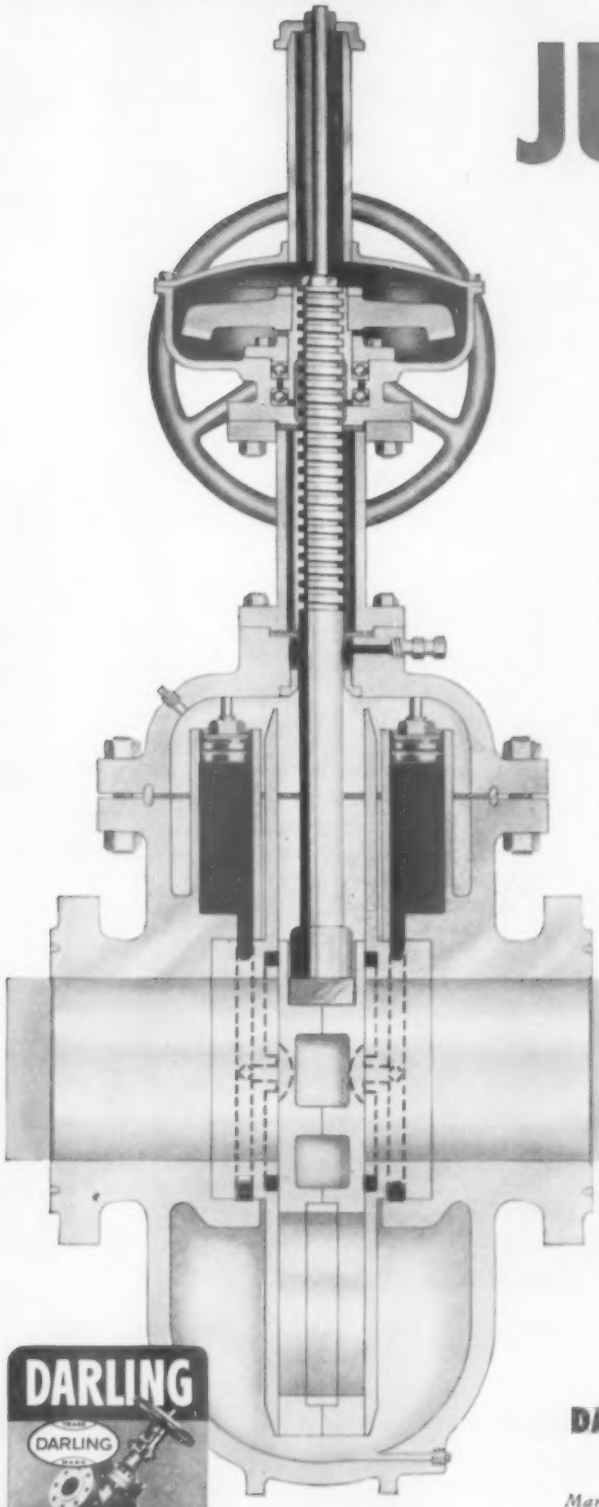
5602

Why DARLING-McEVOY 2-way conduit gate valves

JUST CAN'T LEAK!

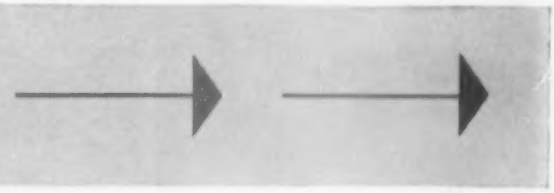


IT'S simple. Regardless of flow direction, a sealant *automatically* completes a pressure-tight seal between the downstream seat and gate. This is the inevitable result of pressure differential at the time of closure.

Similarly there can be no behind-the-seat leakage! For, as shown here, each seat is *double-grooved* to seal against the valve body as well as the gate.

It is this unique feature, with its positive, automatic self-sealing, that establishes the Darling-McEvoy conduit gate valve as the world's tightest!

Isn't it likely that you could benefit by such valve performance as time goes on? Get the *whole* story . . . get details on this and the other unusual features that make these field-proved valves truly outstanding for low-cost, trouble-free operation. Just ask for Bulletin 5402.



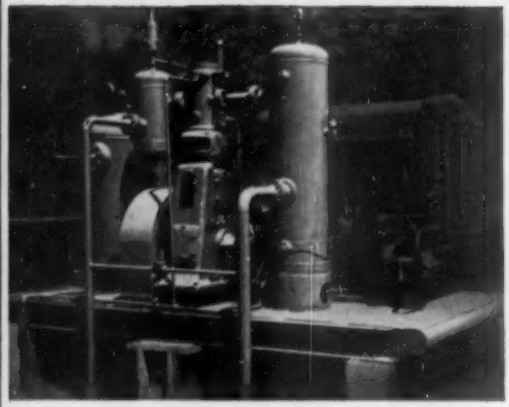
Section view of Darling-McEvoy 2-way conduit gate valve, showing twin sealant reservoirs, double-gate parallel seat design, and sealing grooves. Sizes: 8 inch and larger.

DARLING VALVE & MANUFACTURING CO.

Williamsport 1, Pa.

Manufactured in Canada by Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ont.

THE ONLY MODERN-DESIGN COMPRESSORS FOR GAS BOOSTER OPERATION



Joy WGB-110 Gas Compressor. Inlet pressure 150 psig; Discharge pressure 500 psig. Capacity 1.028 MMCFD. "Packaged" by McNamar Boiler & Tank Co., Tulsa.

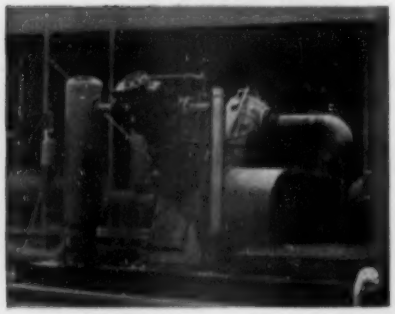
JOY *Packaged* GAS COMPRESSORS

Modern Joy Packaged Gas Compressors are backed by a century-old reputation for low maintenance and long service. These *time-proved* features make Joy Compressors the most reliable for gas gathering, repressuring, or gas lifting:

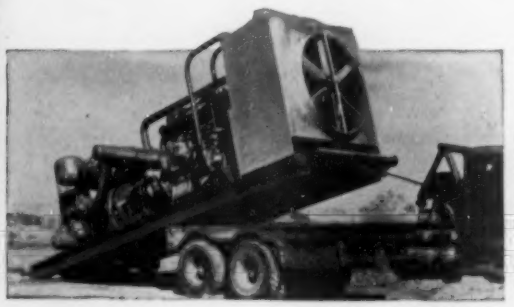
- **Field-replaceable cylinder liners.**
- **Field-replaceable crosshead guides.**
- **Patented Joy "Dual-Cushion" valves.**
- **Full force-feed lubrication.**
- **Anti-friction main bearings.**

Joy Gas Compressors are available in space-saving vertical, V-type, and semi-radial designs . . . single or two-stage units with cylinder sizes from 3" to 13½". Four different frame types accommodate a power range of 50 to 400 HP.

For the most efficient compressor for your needs, consult a Joy Engineer or write to ***Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.*** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*



Joy WNB-112 Gas Compressor. Inlet pressure 35 psia; Discharge pressure 665 psia. Capacity .85 MMCFD. "Packaged" by Oil & Gas Supply Company, Houston.



This photo of a Joy WNB-114 Gas Compressor Package being unloaded onto concrete pad clearly illustrates portability of unit. Inlet pressure is 5 psig; Discharge pressure is 150 psig. Capacity 2 MMCFD. "Packaged" by McNamar Boiler & Tank Co., Tulsa.

Write for FREE Bulletin No. 84-31

Consult a Joy Engineer

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1000 psi
Sizes: 2"-8"

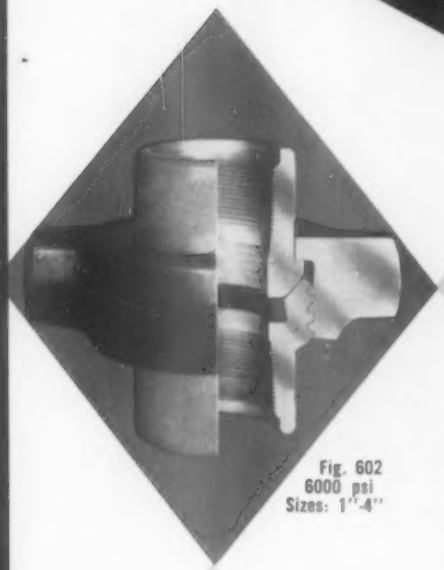


Fig. 602
6000 psi
Sizes: 1"-4"

Fig. 400
4000 psi
Sizes: 6"-12"

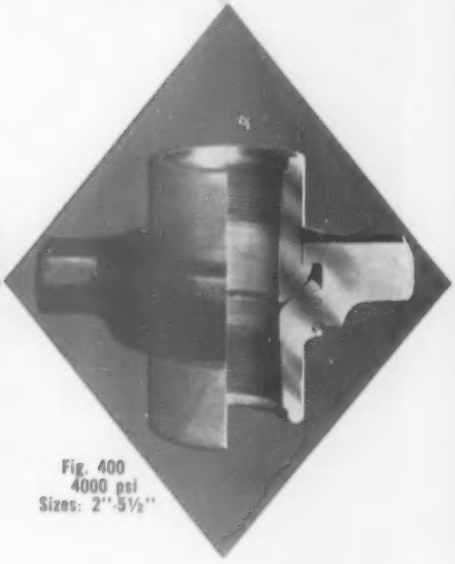


Fig. 400
4000 psi
Sizes: 2"-5½"

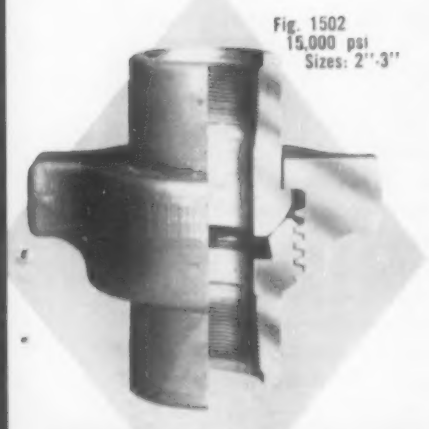


Fig. 1502
15,000 psi
Sizes: 2"-3"

Whether it's for high or low pressures on rig connections or production hook-ups, one of these Weco Unions, in sizes from 1" to 12", pressures from 1000 to 15,000 psi, is designed to do the job better . . . last longer . . . cost less in the long run.

Weco's ball and cone seat is unmatched for dependable leak-proof connections. The rugged Acme threads make-up and break-out fast and easy. The sturdier construction of Weco Unions takes the toughest service as a matter of course. They are available at supply stores everywhere.

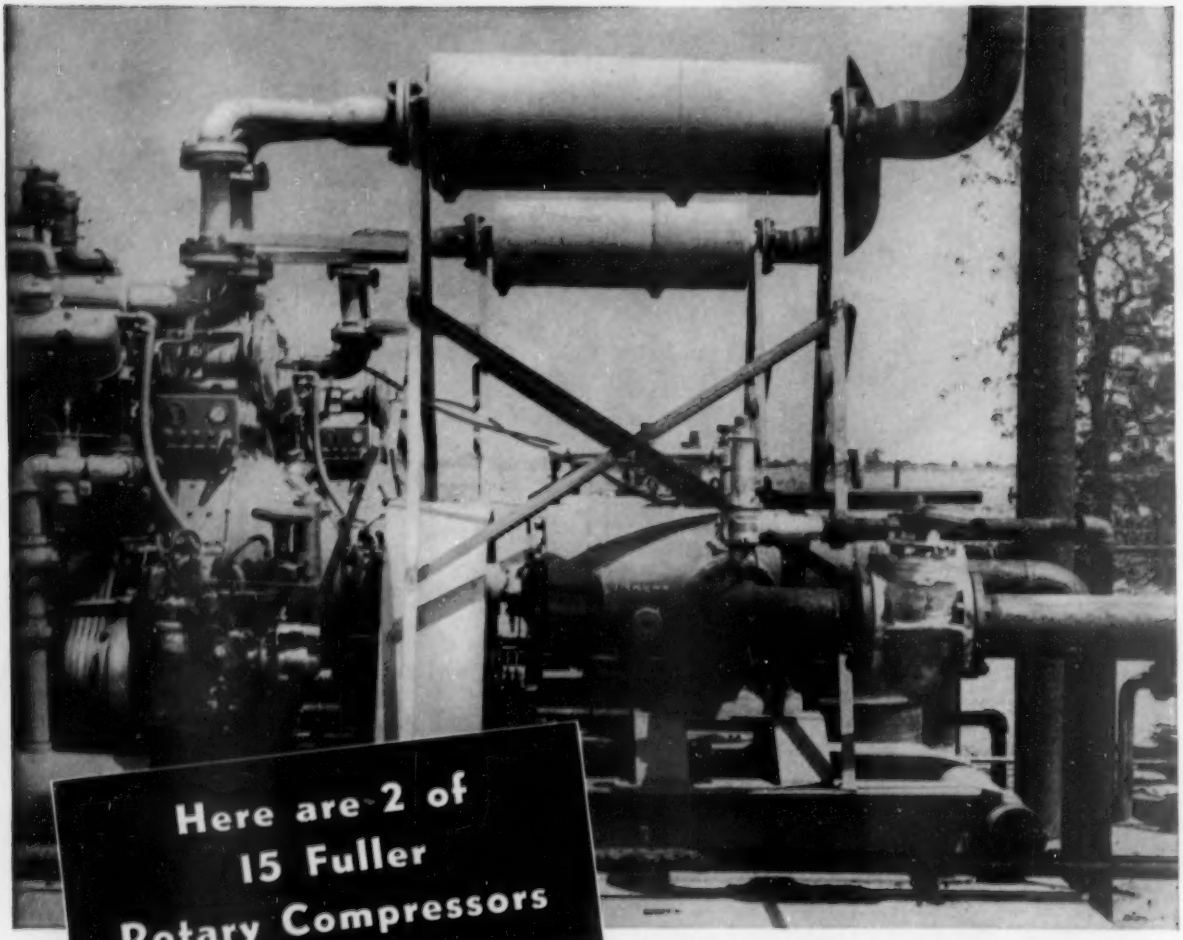
U-3-56

WECO®

WELL EQUIPMENT MFG. CORP.

HOUSTON, TEXAS

Division of CHIKSAN COMPANY *a subsidiary of*
FOOD MACHINERY AND CHEMICAL CORPORATION



Two of the 15 gasoline engine-driven Fuller Rotary Boosters, rated at 1,465,000 standard cubic feet per day at 800 r.p.m.

at "most unusual gasoline plant to go on stream in recent years"

This description of a gasoline plant in northern Texas appears in a recent article in the technical trade press.

One of the unique features is its plant gathering system, comprising between 125 and 150 miles of 2" through 14" pipe.

The plant is served by 15 Fuller Rotary compressors, each with a capacity of 1,500,000 cu. ft. per 24 hrs. Each compressor is a completely independent, skid-mounted unit, taking suction at 0 to 5 psig and discharging gas into the transmission system at 45 psig.

"Most unusual", too, is Fuller performance. Fuller's simple rotary design with a minimum of moving parts makes for smooth, *sure* operation around the clock and unattended. Hundreds of Fuller installations at out-of-the-way well heads attest to the fact that these compressors do the job—and do it *by themselves*.

Whether you're in the market for one or 15 or more compressors, the cold, money-saving facts prove that for workaday dependability, the *lasting* choice is Fuller. We have plenty of information on design characteristics and typical Fuller applications which we'll be happy to send to you.

FULLER COMPANY, 132 Bridge Street Catasauqua, Pa.
GENERAL AMERICAN TRANSPORTATION CORPORATION SUBSIDIARY
Chicago • San Francisco • Los Angeles • Seattle • Birmingham

Fuller
. . . . pioneers in harnessing AIR

C-268
1498

When the pressure is on

As a final step in the manufacture of Powell Valves, every valve is subjected to an *actual line test*—a *positive method* of testing. For special services, valves can be given hydrostatic, air and gas tests so that they will meet various fluid control services.

Thus, when the pressure is on *you*—when you have a production schedule that must be met—that's when you'll be glad you installed Powell Valves.

No matter what your flow control problem may be, Powell has valves designed to solve your problem. And you can *depend* on long, trouble-free service. Through careful quality control, *every* Powell Valve has PERFORMANCE VERIFIED.

Because of Powell's painstaking quality control, plant shutdown through valve failure is greatly reduced. Records from refineries, power and industrial plants the world over prove it.

Consult your Powell Valve distributor. If none is near you, we'll be pleased to tell you about our *complete quality line* which has *Performance Verified.*

The Wm. Powell Company
Cincinnati 22, Ohio
. . . 110th YEAR

PERFORMANCE
PV
VERIFIED

FIG. 1561—150-Pound Steel Swing Check Valve

FIG. 1503—150-Pound Steel Gate Valve

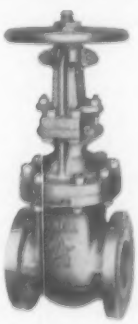


FIG. 2201—175-Pound W.O.G. Semi-Steel Lubricated Plug Valve

Bronze, Iron, Steel and Corrosion-Resistant Valves

POWELL VALVES

EASY LATERAL ADJUSTMENT. A turn of the hex nut moves the suspension ring right or left for perfect lateral balance.

INHERENT BALANCE. BJ patented Gooseneck Hanger combines streamlined design with perfect balance to give the tong a "floating" action.

LONGITUDINAL BALANCE IS SIMPLE MATTER of adjusting set screw at base of hanger.

FITS ALL PIPE SIZES FROM 3½" to 13⅜" by changing to the proper size latch lug jaw.

QUICK-CHANGE LATCH LUG JAWS. The straight hinge pin that retains the jaw is easily removed, permitting fast changes.

HANDY ADJUSTABLE STOP limits the travel of the latch jaw... gives fast grip when tonging small pipe... trips to open jaw wide when large-diameter pipe is being handled.

STRONGER HINGE CONSTRUCTION. Greater strength is provided by large, oversize 1¾" threaded hinge pins double-slotted and doweled against rotation, adjustable to compensate for wear.

BJ RED TOP TONG DIES WEAR LONGER... take a better bite... have extra hardness and chip-proof ends... are tapered for fast changes of dies.

There's no secret why more BJ Type "B" Tongs are used in the oil fields *than all other makes combined*. The popularity of these tongs is based on their balanced suspension, easy latching and rugged construction. These features tell the story.

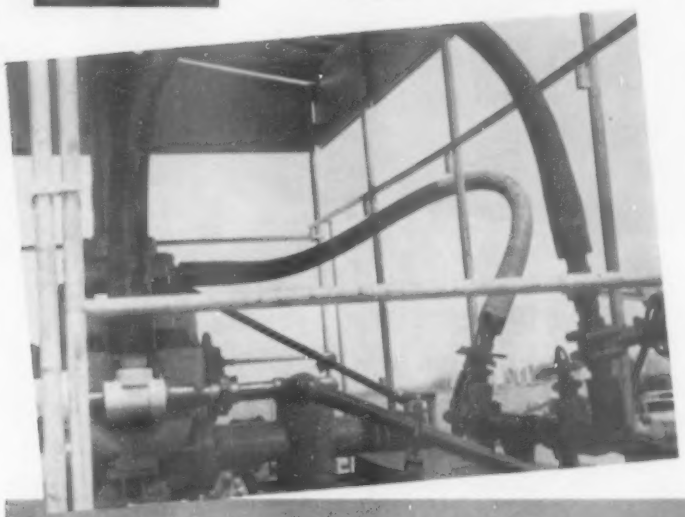
Byron Jackson Tools, Inc.

A Subsidiary of Borg-Warner Corporation

P. O. BOX 2017A, TERMINAL ANNEX • LOS ANGELES 54, CALIFORNIA

Offices in Houston, Fort Worth, Denver and New York.
Sales Engineers in all principal oil fields.
Export Address: 580 Fifth Avenue, Suite 510, New York 36, N. Y.

HERE'S WHY J&L STORES STOCK REPUBLIC HOSE



1. You, the customer, demand the best hose . . . so J & L stocks Republic Hose.
2. You, the customer, demand service . . . so J & L stocks Republic Hose.
3. You, the customer, demand the right hose for the specific application . . . so J & L stocks several kinds of Republic Hose.

When you need the right hose, quick, call your closest J & L store listed below.

LOOK FOR REPUBLIC HOSE AT THESE J & L STORES

ARKANSAS
El Dorado

COLORADO
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ILLINOIS
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Chase, El Dorado, Great Bend, Hill City, McPherson, Russell, Winfield

KENTUCKY
Henderson, Paintsville

LOUISIANA
Bunkie, Harvey, Haynesville, Houma, Lafayette, Lake Charles, Rodessa, Shreveport

MICHIGAN
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MISSISSIPPI
Brookhaven, Laurel, Natchez, Oil City

MONTANA
Cut Bank, Glendive

NEW MEXICO
Hobbs

NEW YORK
Bolivar

NORTH DAKOTA
Williston

OHIO
Canton

OKLAHOMA
Bartlesville, Cushing, Duncan, Healdton, Lindsay, Nowata, Oklahoma City, Okmulgee, Perry, Seminole, Shidler, Tulsa

PENNSYLVANIA
Bradford, Clarion

TEXAS
Alice, Anson, Ballinger, Beaumont, Best, Big Spring, Borger, Corpus Christi, Electra, Freer, Gladewater, Graham, Houston, Kermit, Kilgore, Longview, Luling, Mexia, Midland, Muenster, Odessa, Overton, Pampa, Pleaston, Sherman, Snyder, Sundown, Talco, Victoria, Wichita Falls

WEST VIRGINIA
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WYOMING
Casper, Newcastle, Powell, Worland

Stocked in the Mid-Continent Area by JONES & LAUGHLIN SUPPLY DIVISION P.O. Drawer 2481, Tulsa 2, Okla. and the J & L Store in YOUR field.

REPUBLIC RUBBER DIVISION
LEE RUBBER & TIRE CORPORATION, YOUNGSTOWN 1, OHIO
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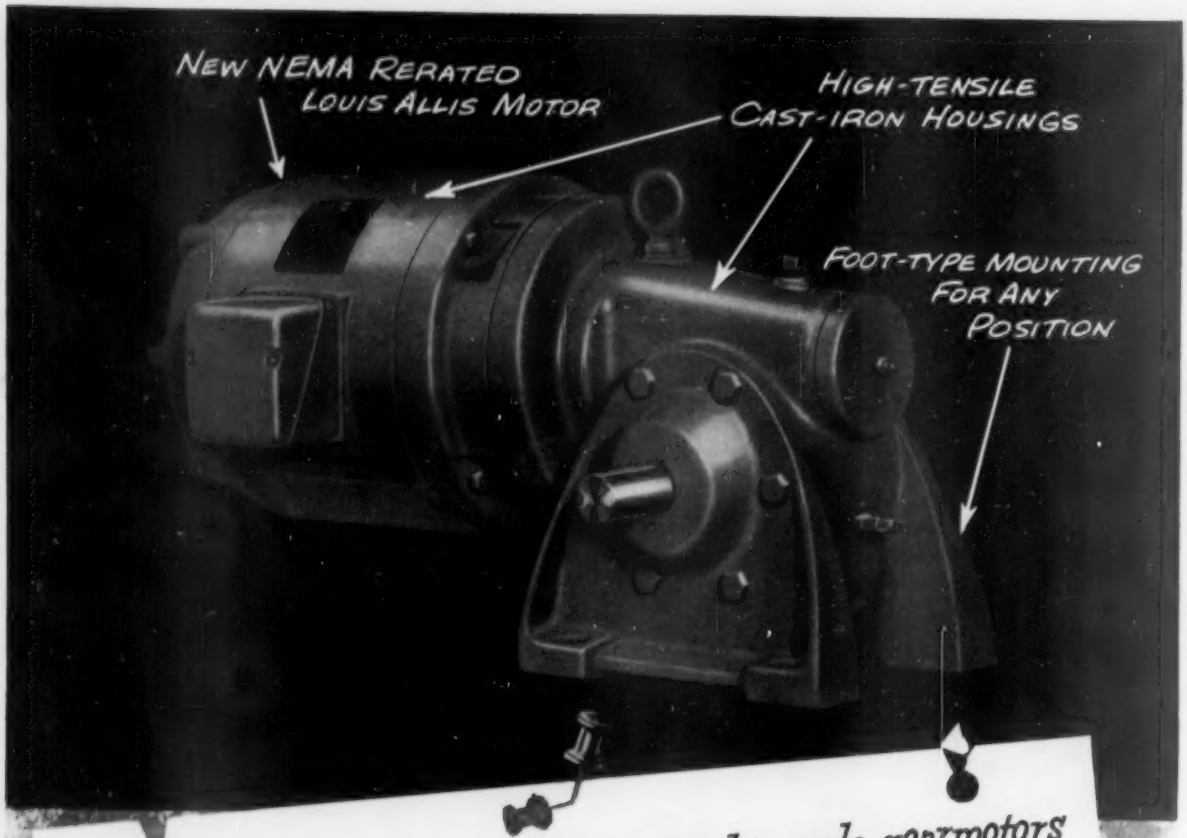

Louis Allis announces its L.A. line of right-angle gearmotors

Now available with new NEMA rerated L.A. motors for all applications — in sizes from 1/3 to 30 hp

Before we go into the many design features of this compact gearmotor, let's take a look at a few other advantages:

First of all, you can get either foot- or flange-mounted units. Secondly, you can have any motor enclosure you want. And finally, you can have any electrical or mechanical modification needed for any specific application.

In other words, here's a line of gearmotors ruggedly designed, versatile and efficient—to give you a sound answer to your right-angle gearmotor drive problems. Here's why:

- Both gear and motor housings are made of high-tensile cast iron to provide maximum strength, rigidity, and compactness.
- The worm, carefully machined from hardened alloy steel, is ground to close tolerances to give greater efficiency and longer life.
- The worm gear is cut from a high grade of wear-resistant alloy bronze.
- A double-row angular contact bearing and a ball bearing provide for radial and thrust loads on the worm shaft.
- The output shaft is mounted in tapered roller bearings for maximum load-carrying capacity.
- Ample oil-bath lubrication assures longer life and minimum maintenance.
- Special oil seals on all shafts keep the oil in--dirt out and permit any mounting arrangement.

Here's a line of right-angle gearmotors that's very easy to apply. Standard speed range from 7-1/2 to 300 rpm--special speeds also are available.

Flange-mounted right-angle gearmotor with new L.A. line explosion-proof motor

GM-102

THE LOUIS ALLIS CO.
MILWAUKEE 7, WISCONSIN

...it stands alone-

In this latest development we reaffirm our pledge to make a better gauge ever better. Only in the Marsh Christmas Tree Gauge you have:

—**A better tube construction**— bourdon tube and socket fused into a one piece permanently leak-proof unit by the exclusive Marsh "Conoweld" process.

—**A better movement**— all but frictionless as a result of the self-lubricating effect of unlike metals. Coined sector gear gives greater strength where greater strength is needed; also smoother operation.

—**A better case**— a copper-clad wrought steel case of boiler plate thickness, produced by the "Marsh-alloy" process. It has the strength of steel, the corrosion resistance of copper, and is one-third lighter than conventional cast-iron cases. The case is finished in corrosion-resistant satin black enamel.

—**the Marsh "Recalibrator"**— not only the handiest way to keep a gauge accurate; also the *best* way.

★ There is a Marsh Gauge for every oil country and refinery application. Ask your supply house or write for latest bulletins.

MARSH INSTRUMENT CO.

Sales affiliate of Jas. P. Marsh Corporation

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MARSH STOCKED by Your Local Supply Store **GAUGES**

AEROLUBE® 93-C

ZINC DITHIOPHOSPHATE

Fights Wear...cuts engine repair

Test-engine valve lifter above was protected by oil containing AEROLUBE 93-C Zinc Dithiophosphate. Badly worn valve lifter below received ordinary lubrication.

Nine out of ten new cars today are delivered with zinc dithiophosphate in the initial fill or "break-in" oil.

The reason? Major automotive manufacturers have found zinc dithiophosphate the most effective wear inhibitor, particularly in the valve train mechanisms of modern V-8 high-compression engines.

Best of the zinc dithiophosphates is Cyanamid's AEROLUBE 93-C, specially modified to give superior antiwear characteristics. It also controls oil oxidation and checks formation of oil-insoluble sludges and varnishes. It retards formation of peroxides and organic acids that corrode cadmium-silver and copper-lead bearings.

Very light in color, compatible with all lube oil stocks and other additives, AEROLUBE 93-C may be used alone for API Service MM and initial fill requirements, or with detergents such as AEROLUBE 90 for heavy-duty formulations.

Whether you are formulating lube oil for initial fill or day-to-day service, try AEROLUBE 93-C Zinc Dithiophosphate for better control of wear, oil oxidation and bearing corrosion.

CYANAMID

AMERICAN CYANAMID COMPANY
REFINERY CHEMICALS DEPARTMENT
30 Rockefeller Plaza, New York 20, N.Y.

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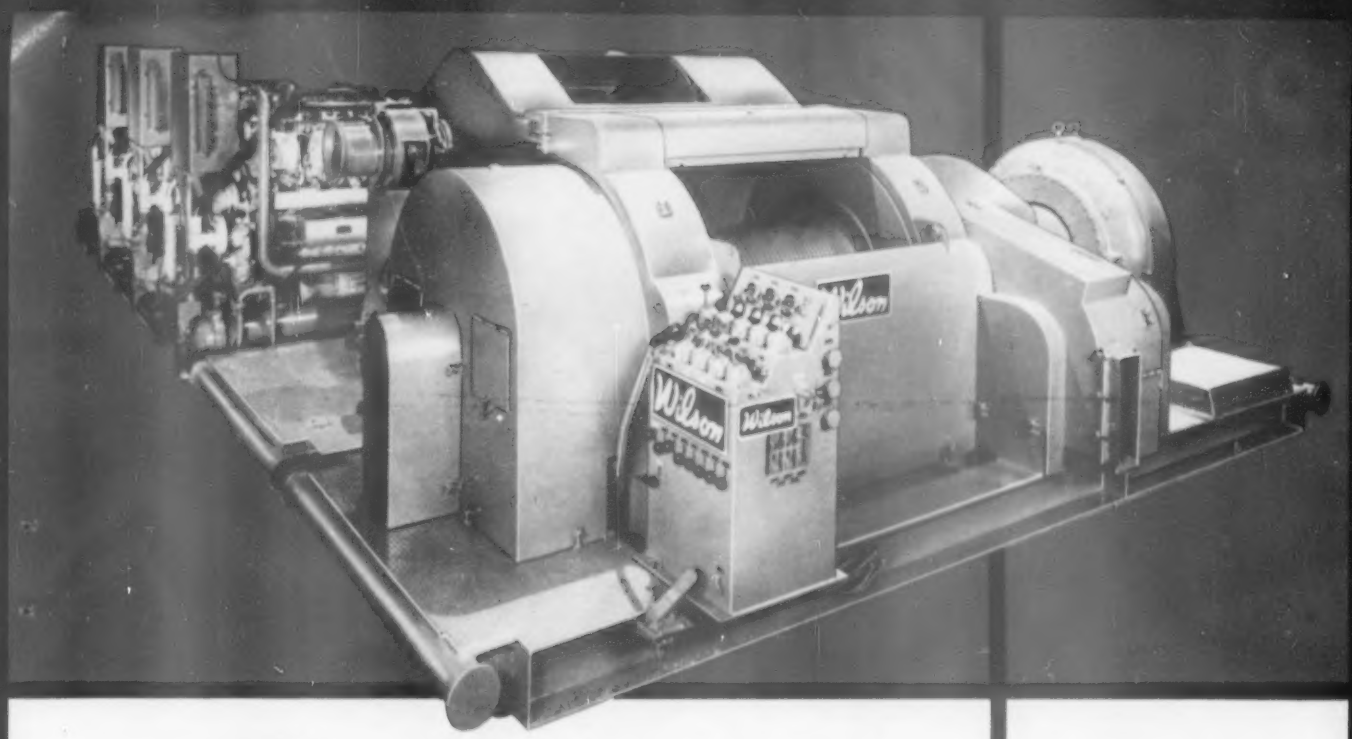

SUPER TITAN "66"

THE LARGEST RIG IN THE WORLD

DESIGNED FOR BARGE OR LAND DRILLING
MANY NEW EXCLUSIVE WILSON FEATURES

INVESTIGATE SUCH FEATURES AS:

- 48 Inch, 2 Plate Air-Tube Clutch on Low Drum Drive
- 48 Inch, 1 Plate Air-Tube Clutch on High Drum Drive
- Chains in Oil Bath Cases, Outside the Frame
- Air Power-Operated Brakes, with Equalizer Beam in Front—Single Nut Adjustment—a Brake That Can *NOT* Kick!
- Three Speed Forward and Reverse, All Air-Tube Friction Clutch Transmission . . . . . and Many Others

WILSON

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CO., Inc.

WICHITA FALLS, TEXAS
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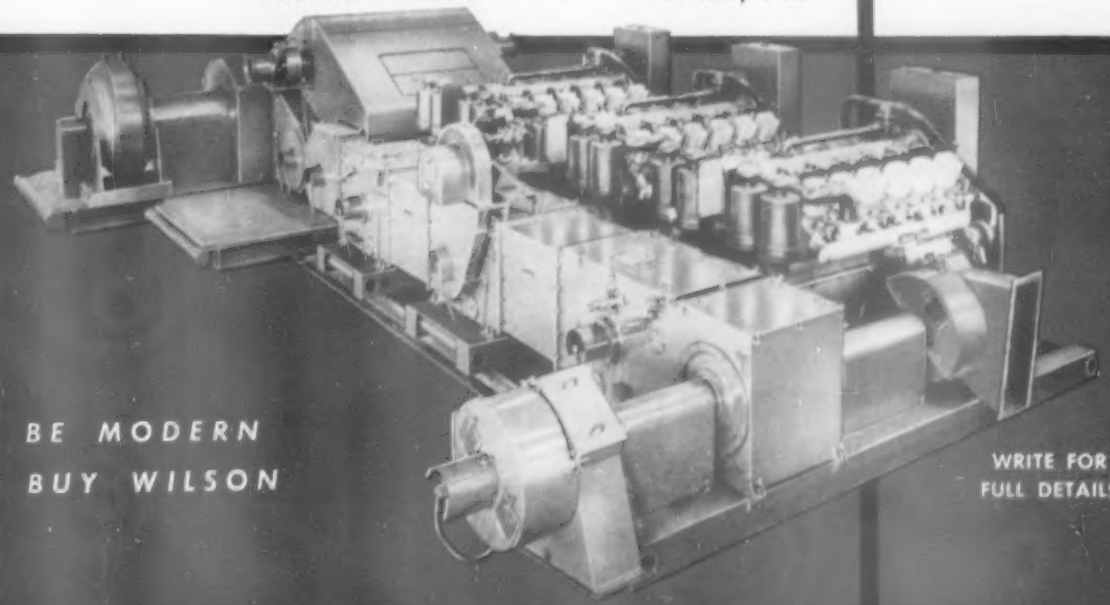
The Home of
RED IRON



BE MODERN
BUY WILSON

WRITE FOR
FULL DETAILS

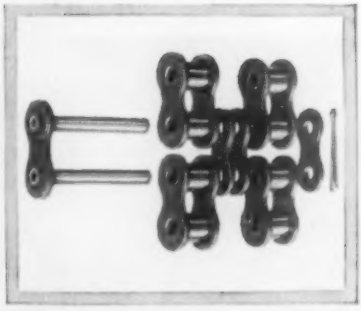
You need easy assembly and disassembly in roller chains, too...

You know what it means, *in time and money*, to have roller chains on your rigs that take sledges, drift pins, plenty of muscle, a crew, and plenty of time to take apart...and just as much effort to assemble on the drive. It's expensive!

That's why you should have easy-to-assemble, easy-to-take-apart Rex Roller Chains on your rigs. Even multiple strands can be taken apart, easily, at any link in the strand. And you don't sacrifice any chain life with these chains. Here's why:

Rex Oil Field Roller Chains are designed so that the pins are a press fit—*for holding power*—in the outer side plates. They are a "glide fit" through the roller link and inner link plates. They're easy to take apart—and there's no better chain made!

Get the complete time-saving, cost-saving story from your supply store, your Rex® Field Sales Engineer, or write directly for Catalog No. 55-3 to CHAIN Belt Company, 4619 W. Greenfield Ave., Milwaukee 1, Wisconsin.



CHAIN BELT COMPANY

MILWAUKEE 1, WISCONSIN

OIL FIELD OFFICES: DALLAS • HOUSTON • TULSA • MIDLAND • LOS ANGELES • NEW YORK

ENDCOR 50

- *DEARBORN'S POLYAMIDE CORROSION INHIBITOR*
- *PERMANENTLY STABLE IN BRINE*

WHAT ENDCOR IS: It is a specific chemical treatment for control of corrosion in both sweet and sour wells. ENDCOR 50 is a strongly polar type polyamide corrosion inhibitor incorporated in a non-oil-soluble, water-dispersible liquid carrier. ENDCOR 50 is not a salt. It is a stable molecular compound. At normal dosage levels, this inhibitor does not promote emulsification but instead acts as an emulsion breaker.

HOW ENDCOR 50 WORKS: When introduced into the annulus of a producing well, ENDCOR 50 passes through the casing oil layer and rapidly disperses in the underlying brine. When thus dispersed, ENDCOR 50 will be preferentially absorbed as an impervious film on metal surfaces of pumps, tubing, rods and flow lines. This provides positive protection against corrosive elements in the oil or brine.

FULLY FIELD TESTED: The outstanding performance efficiency of ENDCOR 50 has been thoroughly demonstrated by standard laboratory methods as well as by extensive field tests. A sample is available upon request.

Dearborn Chemical Company has been a leader in the field of corrosion prevention and water conditioning since 1887. During this time, Dearborn has supplied the oil field industry not only with NO-OX-ID® Coatings and Wrappers for the protection of pipelines, but also with boiler water and cooling water treatment in refineries.

Dearborn®

COMBATTING CORROSION WHEREVER IT OCCURS

MAIL THE COUPON for your copy of Dearborn Bulletin 5500-A. It gives all the facts on ENDCOR 50.

DEARBORN CHEMICAL COMPANY, DEPT. OG
Merchandise Mart Plaza, Chicago 54, Ill.

Gentlemen: Please send me Bulletin 5500-A.

Name.....*Title*.....

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City.....*Zone*.....*State*.....

H&L
Teeth that really DIG
SHARP teeth mean more ditch
FORGED ALLOY STEEL D means greater strength
added up means more profit
H&L TOOTH COMPANY
1540 South Greenwood Avenue
Montebello, California
25th Silver Anniversary

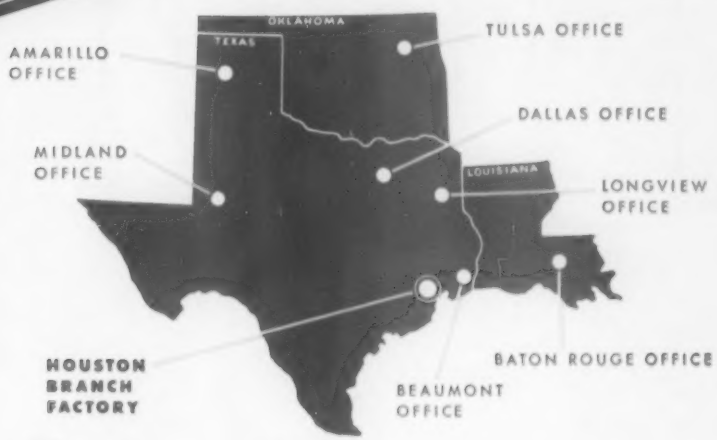
OPERATIONS TEXAS...

Houston branch factory is conveniently located outside downtown area. Fifteen qualified employees are ready to serve you. Over 12,000 sq. ft. house manufacturing, stock and complete service facilities.

JOHN CRANE

Packings are available in all styles, types and sizes. Shown here is the ring department using assembly line method to produce die-formed rings.

Here is the largest stock of mechanical seals and mechanical seal parts in the Southwest. All items are ready for immediate shipment.



Complete Service in the Heart of the Oil Country

Mechanical seals...mechanical packings...PLS pipe thread compounds...Teflon* products ...Lapmaster lapping machines and lapping service...as near to you as your telephone.

"John Crane" facilities and service are available from branch offices located throughout the rich oil producing areas of the South and Southwest. Hub of the "operation" is the completely stocked branch factory at Houston, Texas.

Whatever your requirement...whatever your problem...call your nearest "John Crane" representative for prompt service and the results you want.

Remember: ***Your toughest problem can be "John Crane's" next success story.***

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*DuPont trademark

JOHN CRANE **CRANE PACKING COMPANY** 38 YEARS INDUSTRIAL PROGRESS

Home Office: 6419 OAKTON ST., MORTON GROVE, ILL., (Chicago Suburb)

FLOW!

LINE PIPE IN ACCORDANCE WITH AMERICAN PETROLEUM INSTITUTE SPECIFICATIONS

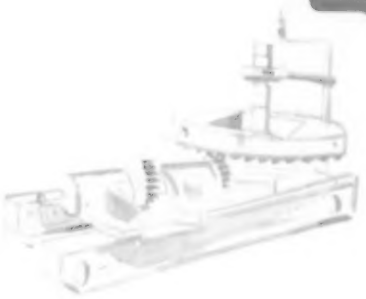
- pipe with the yearmark!

WHEATLAND TUBE COMPANY

Bankers Securities Building, Philadelphia 7, Pa. Mills · Wheatland, Pa. · Delair, N.J.

OVER
45
YEARS
EXPERIENCE

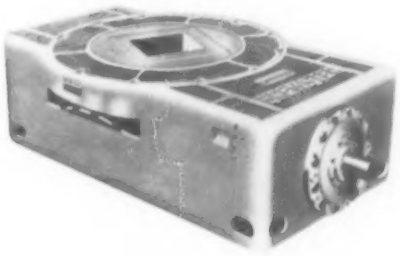
BREWSTER



THIS BREWSTER ROTARY LED THE FIELD IN 1910 – A LEADERSHIP THAT HAS CONTINUED WITH EACH SUCCESSIVE MODEL FOR 46 YEARS. TODAY BREWSTER ROTARIES ARE THE FINEST EVER OFFERED.

You can be sure of more hole, faster, when you run Brewster Rotaries. From top to bottom, they are built to take any drilling condition you will ever meet. These rotaries are simply and ruggedly designed; there are no complicated parts or delicate adjustments. Completely sealed against mud and foreign matter, they spend more hours on the job, have less down time and last longer than any rotaries of equal capacity. Performance records covering millions of feet of hole prove that with faster drilling speeds and lower maintenance costs, Brewster Rotary tables pay for themselves over and over.

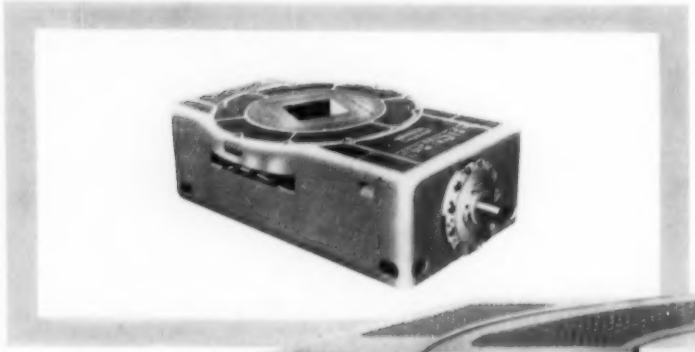
OIL BATH ROTARIES

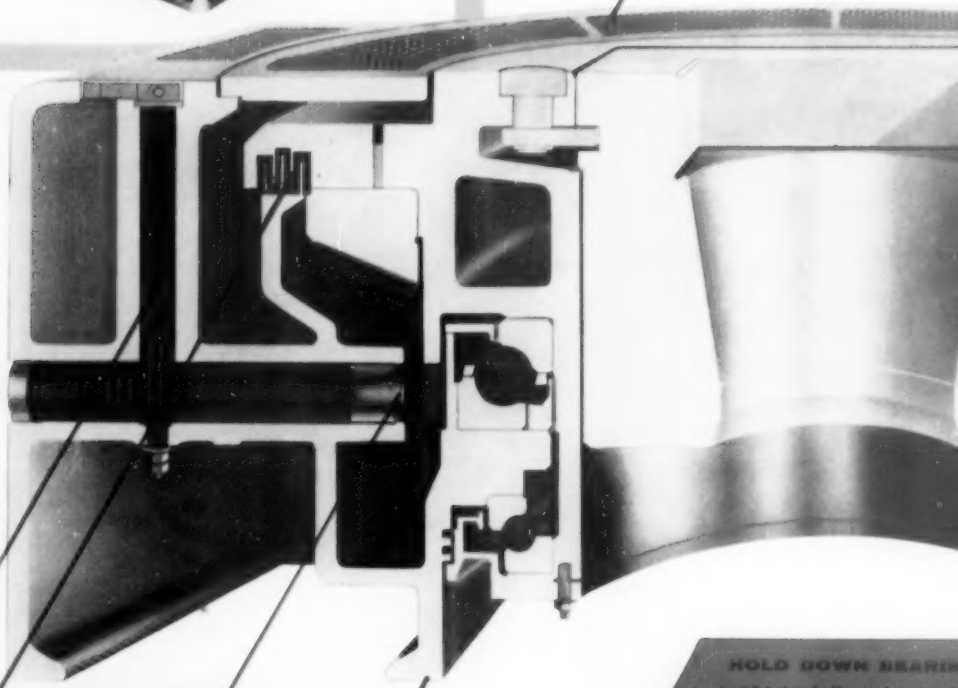


Now available in a complete size range from 12-inch to 27½-inch table opening, there is a Brewster Oil-Bath rotary to suit every drilling need. Ask your supply house or write to Brewster direct for complete information.

Tough Rotaries meet Tough Service...

COMPARE THESE BREWS





RSH-18
OIL BATH
ROTARY

GREASE LUBRICATION

OIL LUBRICATION

FLUSH DECK

Free of projections and
treaded to afford safe fo
crew.

HOLD DOWN BEARIN

Anti-friction ball-type bearing
gears accurately meshed and
table in alignment under hea
loads — eliminates vertical slac
the assembly. Has individual g
lubrication.

TABLE LOCK

Easily accessible for rapid operation. Flush with table top for working safety.

MUD SEAL

Triple groove labyrinth keeps gear compartment from drilling mud. Has no friction fit parts to wear out.

HEAVY STEEL BED

Thoroughly heat treated to develop maximum physical properties. Rugged construction prevents distortion under heavy loads and maintains exact alignment of gears.

**TWO D
TIMKEN**

Handle both
Extra high
bearing has
shock. Lubric
Alemite fitting
cation port.

LOCK PIN

Engages slot preventing any transfer of shock to gears, bearings or shaft.

EWSTER EXTRA LIFE FEATURES

USH DECK

jections and diamond afford safe footing for

MAIN BEARING

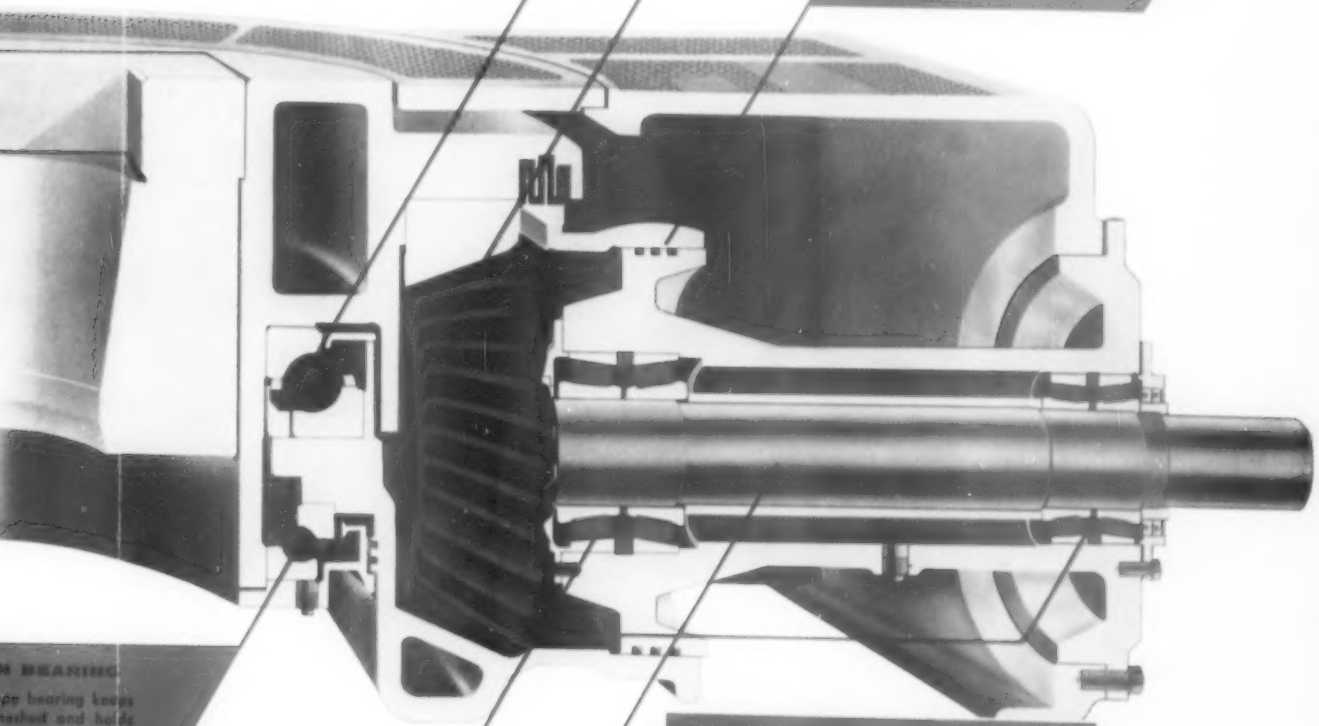
Main bearing heavy duty steel balls mounted in hardened steel races. A bronze retainer ring holds balls in even spacing.

RING GEAR AND PINION

Spiral bevel gears, machined from heat-treated alloy steel, is oil lubricated from own separate reservoir.

OIL SEALS

Triple "O" ring seals keep dirt and foreign matter out of gear compartment.



N BEARING

pe bearing keeps ashed and holds under heaviest vertical slack in individual grease

TWO DOUBLE-ROW TIMKEN BEARINGS

andle both thrust and radial loads. tra high in capacity, this type earing has great resistance to ock. Lubrication is furnished by emite fittings grouped at the lubrication port.

SHAFT

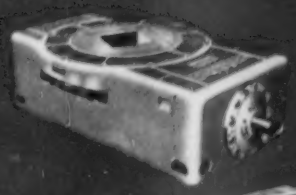
Heat-treated alloy steel, machined to close tolerance for accurate fit and smooth operation.

LUBRIPORT

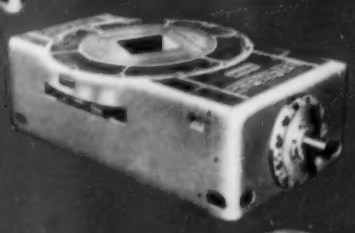
An exclusive Brewster development shields and protects all lubricating fittings and oil plugs. From this one point on a Brewster table every part may be individually lubricated. Separate oil reservoirs for main bearings and for ring gear and pinion prevents contamination of bearings from metal particles produced by gear wear. Grease lubrication of pinion and hold-down bearings provides instant lubrication regardless of how cold temperatures are when table is started up.

A size for economical drilling...

AT EVERY DEPTH



18" MODEL RSH-18
Center distances 44" and 53½"



22" MODEL RSH-22
Center distance 53½"

27½" MODEL RSH 27½
Center distance 59½"

THE BREWSTER COMPANY, INC.

SUPPLY HOUSES

Howard Supply Company – Apex Equipment Company – Bovaird Supply Company – Industrial Supply Company – Murray Brooks, Inc. United Supply and Manufacturing Company – For Canada, Mexico and Export Sales: The Brewster Company

18" MODEL OS-18
Center distances 43" to 45"

12" MODEL OS-12-L
Center distances 43" to 45"

12" MODEL OS-12-S
Center distances 28½" to 30"

This is Why the Nash is the Most Simple Compressor

It's the Nash!

There are no mechanical complications in a Nash Compressor. A single moving element, a round rotor, with shrouded blades, forming a series of buckets, revolves freely in an elliptical casing containing any low viscosity liquid. This liquid, carried with the rotor, follows the elliptical contour of the casing.

The moving liquid therefore recedes from the rotor buckets at the wide part of the ellipse, permitting the buckets to fill with gas from the stationary Inlet Ports. As the casing narrows, the liquid is forced back into the rotor buckets, compressing the gas, and delivering it through the fixed Outlet Ports.

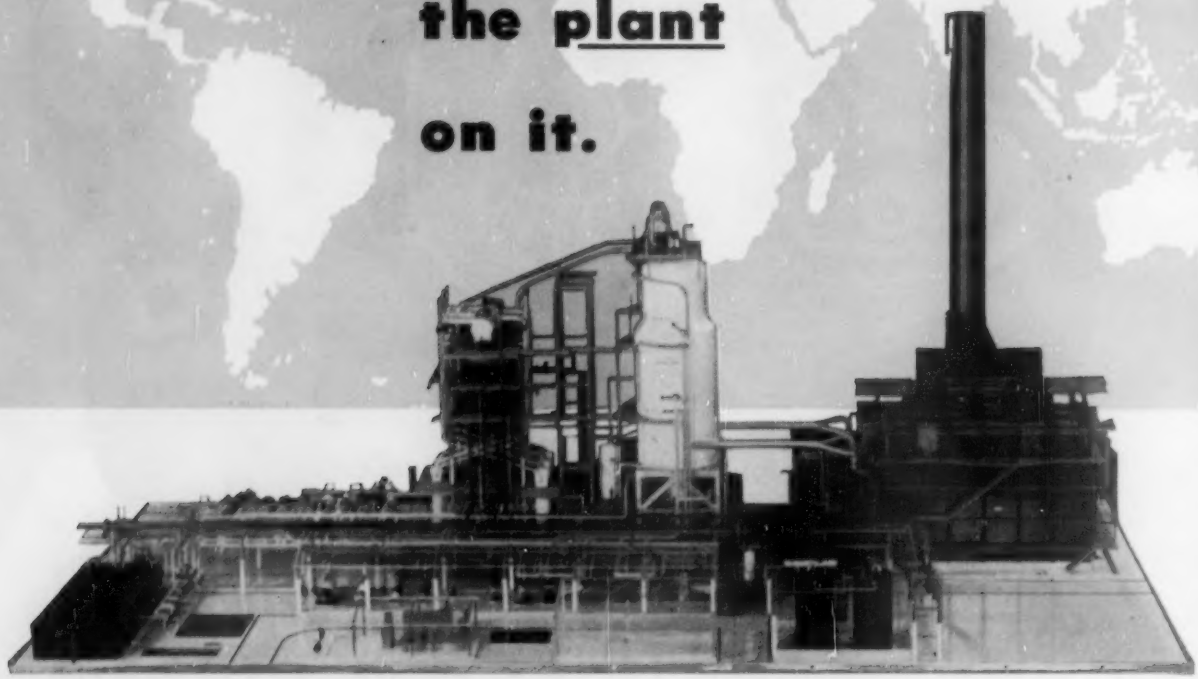
Nash Compressors produce 75 lbs pressure in a single stage, with capacities to 6 million cu. ft. per day in a single structure. Since compression is secured by an entirely different principle, gas pumping problems difficult with ordinary pumps are often handled easily in a Nash.

Nash simplicity means low maintenance cost, with original pump performance constant over long periods Data on these pumps sent immediately on request

- No internal wearing parts.
- No valves, pistons, or vanes.
- No internal lubrication.
- Low maintenance cost.
- Saves floor space.
- Desired delivery temperature automatically maintained.
- Slugs of liquid entering pump will do no harm.
- 75 pounds in a single stage.

NASH ENGINEERING COMPANY
313 WILSON, SO. NORWALK, CONN.

You pick the place... we'll put the plant on it.



IN fact, McKee's fifty years of experience in designing and building plants for major industries can be a valuable help to you in selecting the site.

And McKee can undertake the entire project from preliminary studies to completed plant, ready for initial operation, under a *single contract.*

You'll find physical evidence of the excellence of McKee engineering and construction in successfully operating plants all over the world. If you want your new plant designed and built to earn a profit *call in McKee.*

McKee
ENGINEERING & CONSTRUCTION Services

Arthur G. McKee & Company • Engineers and Contractors

Headquarters: McKee Building • 2300 Chester Avenue • Cleveland 1, Ohio
Offices: New York, N. Y. • Union, New Jersey • Washington, D. C.
British Representatives of Metals Division: Head, Wrightson & Co., Limited
Canada: Arthur G. McKee & Company of Canada, Ltd., 372 Bay St., Toronto

made for western style perforating

From the gun collection of The Museum, Texas Technological College

Winchester's famous Model "73", the gun that "won the old West."

GO WESTERN

- In the new West, Western's *ROCKET JET GUN* is setting the style for oil well perforating. The Rocket Jet Gun is unmatched in efficiency of design and charge performance.
- Just as the Winchester "73" made its mark on history as a precision instrument, Western's Rocket Jet is making its mark on the oil industry as a superior way to perforate.
- There's no extra charge for the premium perforating of Western's Rocket Jet Gun . . . . you get greater entry hole size and greater penetration.

Next time, *GO WESTERN!*

WESTERN Engineered WELL SERVICES

engineered well services

THE WESTERN COMPANY

general offices: Midland, Texas

Texas: Odessa, Seagraves, Levelland, Snyder, Lubbock, Borger / Oklahoma: Lindsay, Healdton, Okla. City / New Mexico: Hobbs / Kansas: Ulysses, Liberal

R/M Poly-V® Drive Saves Space and Weight —Boosts Power Delivery!

No matching problem . . . less shaft overhang . . . less drive weight . . . but *greater* power capacity! These are only a few reasons why the R/M Poly-V* Drive has proved the greatest advance in power transmission drive development since the multiple V-belt. No other belt drive can deliver as much power in as little space as patented R/M Poly-V Drive!

A single, endless parallel V-ribbed belt runs on sheaves grooved to mate precisely with the belt ribs. Poly-V Belt covers the entire width of the drive sheave with a continuous strength member of super-strength synthetic cord. Sheaves, therefore, can be narrower, lighter, because the uniform pull of this single unit belt delivers more power per inch of drive width. Poly-V Drive delivers up to 50% more power in the same space as multiple V-belt drives . . . or equal power in ⅔ the space!

Poly-V Drive eliminates multiple-belt "length matching" problems. Uniform power delivery and drive dependability is not limited to individual V-belt life. Speed ratios remain constant—from no load to full load. Poly-V belts are oil proof, non-spark and heat resistant. Just two cross sections of Poly-V Drive meet every heavy-duty power requirement, reducing costly belt and sheave inventories to a new low.

R/M engineers are prepared to show you how R/M Poly-V Drive has improved heavy duty power transmission in many industries . . . and how it can improve your belted drives—give you "More Use per Dollar." Contact R/M . . . or write for Poly-V Drive Bulletin #6638.

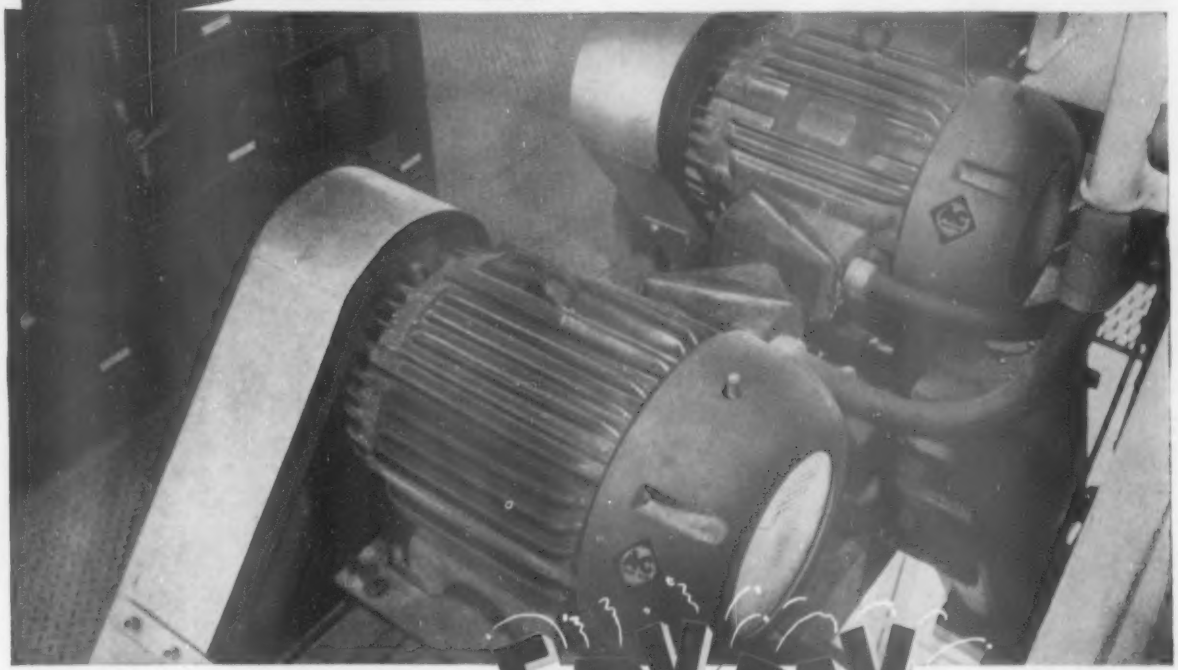
*Poly-V is a registered Raybestos-Manhattan trademark. RM 410

MANHATTAN RUBBER DIVISION—PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

Other R/M products include: Industrial Rubber • Fan Belts • Radiator Hose • Brake Linings • Brake Blocks • Clutch Facings Asbestos Textiles • Packings • Engineered Plastic, and Sintered Metal Products • Laundry Pads and Covers • Bowling Balls

There's **MORE** Cooling Surface in these deep-ribbed **MOTORS**



No Day is FRYDAY

with these Allis-Chalmers MOTORS

● Frying of insulation is impossible under normal conditions with the extra-large cooling surface of Allis-Chalmers rib-type TEFC motors. The result — you expect and get longer motor life.

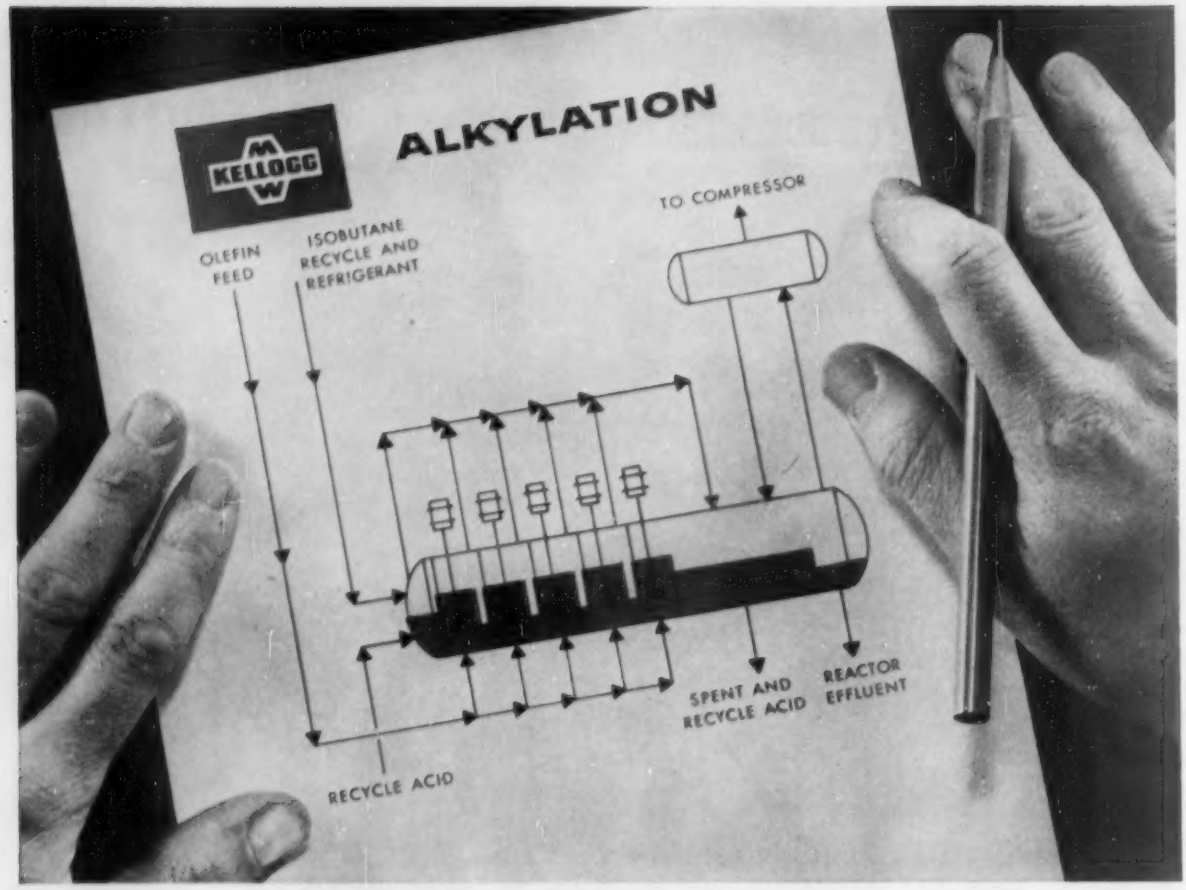
The engineered partner of A-C motors is Allis-Chalmers control.

Get Complete Information

As a new machinery component or as replacement, specify Allis-Chalmers. Discuss your particular application with your nearby A-C distributor, A-C district office, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

A-4940



Lower Investment in Recycle Equipment with Multiple Stage Cascade Reactor

With more and more refiners expanding their alkylation capacity, attention is focussed again on the equipment economy and isobutane efficiency of M. W. Kellogg's cascade reactor as compared with earlier jet-type systems.

In a 2,500 BPD alkylation plant, for example, Kellogg's five-stage design reduces the number of reactors required from four to one! Instead of the approximate 12,800 BPD of isobutane recycle needed for the four individual reactors, Kellogg's single reactor requires only 4,500 BPD recycle!

In addition, the isobutane tower is reduced from 13½ to 7 feet in diameter. Exchangers, condensers, reboilers, pumps, piping, and other auxiliary equipment are proportionately smaller. And one centrifugal compressor replaces three reciprocating machines.

M. W. Kellogg welcomes the opportunity to discuss with you the improvements it is continuously making in its alkylation techniques. Recent examples are a cascade reactor with *seven* reaction zones, and the new bauxite process—developed jointly with D-X Sunray Oil Company—which reduces corrosion and fouling of fractionating units.

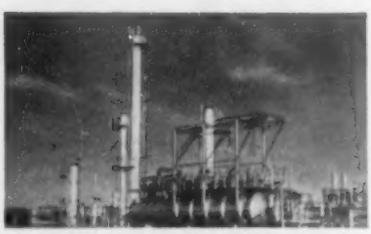
Refinery Process Division

THE M. W. KELLOGG COMPANY

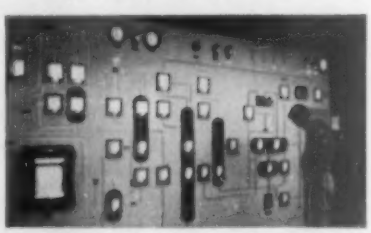
711 Third Avenue, New York 17, N. Y.

The Canadian Kellogg Company Limited, Toronto · Kellogg International Corporation, London

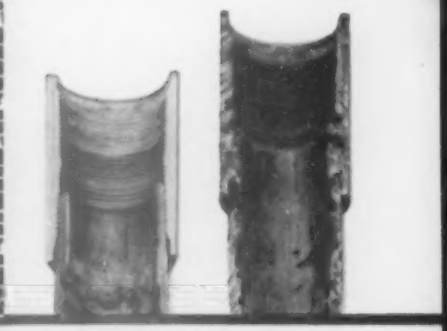
SUBSIDIARIES OF PULLMAN INCORPORATED



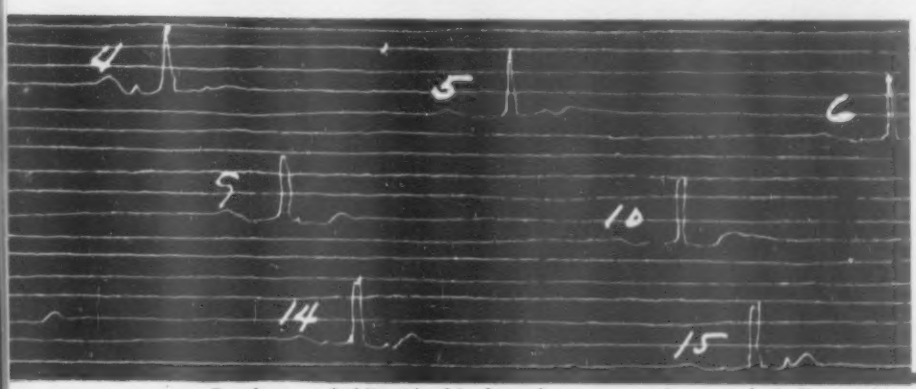
A recent installation of M. W. Kellogg's sulfuric acid alkylation process clearly shows the unique cascade reactor.

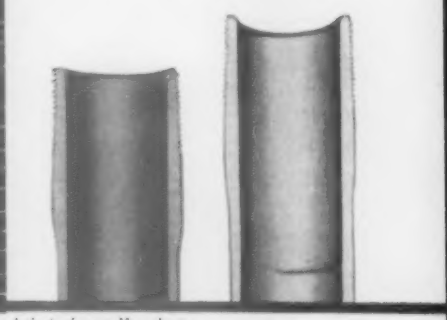


Control panel for units shown in the other photograph, with instruments identified by color-coded silhouettes.



A caliper survey was made to detect corrosion of oil-well tubing. Erratic "blips" on the survey chart indicate corrosion in well using ordinary inhibitor. Parts of two corroded tubes are shown at right.





Evenly spaced "blips" in this chart show no corrosion, merely indicate tubing joints in well using inhibitor containing Sunaptic acid. The tubes look like new. Both surveys taken after one year.

KING-SIZE ACID MOLECULE DOUBLES EFFICIENCY OF CORROSION INHIBITOR

Any product you're now making with fatty, rosin, synthetic or ordinary naphthenic acids stands a good chance of improvement with Sunaptic acids

In the above test, the substitution of high-molecular-weight Sunaptic® acid for fatty, rosin, synthetic and ordinary naphthenic acids proved to be the prime reason for improving the corrosion inhibitor.

During a year of testing, the Sunaptic acid type corrosion inhibitor completely eliminated service jobs due to corrosion. In a similar period, rust and corrosion resulted in nine service jobs while using an ordinary corrosion inhibitor.

Other unusual properties: no olefinic unsaturation, high resistance to oxidative rancidity, low freezing or pour points, and a higher hydrocarbon solubility than ordinary naphthenic, fatty and rosin acids.

Typical applications of Sunaptic acid derivatives include anti-oxidants, oil-soluble detergents, lubricant additives and plasticizers.

For free literature on Sunaptic acids and their uses, see your Sun representative, or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. OG-6.

For information about where you may obtain oil-well corrosion inhibitors fortified with Sunaptic acid, write to SUN OIL COMPANY, Philadelphia 3, Pa., Dept. OG-6.

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY PHILA. 3, PA.

© SUN OIL COMPANY

IN CANADA: SUN OIL COMPANY LIMITED, TORONTO AND MONTREAL

SUNOCO

Three 125,000 #/HR STEAM GENERATORS *by* Vogt AT LION OIL COMPANY'S BARTON CHEMICAL PLANT

★ The new $30 million Lion Oil Company's Barton Chemical Plant at Luling, La. produces 300 tons daily of essential nitrogen fertilizer materials to boost crop yields and reduce unit production costs on the nation's farms.

PRINCIPAL DATA, EACH UNIT

125,000 pounds per hour capacity.

Fusion welded steam and water drums designed for 725 lbs. S.W.P.

Superheater delivers steam at 750°F. total temperature.

Water cooled furnace.

Burners for Gas and Oil fuel.

Vogt offers a complete line of custom built type and package unit type steam generators. Available in bent tube types and straight tube, forged steel sectional header types for solid, liquid, or gaseous fuel burned singly or in combination. Write for bulletin 24-BO.

Henry Vogt Machine Co., Louisville, Ky.

BRANCH OFFICES:
New York, Philadelphia, Chicago, Cleveland, St. Louis, Dallas, Charleston, W. Va., San Francisco

Pumping Progress Report

FOR PIPELINE ENGINEERS

An advertisement prepared by the Aldrich Pump Co., Member of Hydraulic Institute, U.S.A.

PUMPING LIQUID BUTANE AND PROPANE is a typical operational headache successfully handled by the Aldrich Pump Company Engineers. It was a particularly tough pumping problem for one large pipe line company; they had to move butane 186 miles — from a Texas oil field to a Gulf Coast refinery.

PUMPING LIGHT-GRAVITY FLUID AT HIGH PRESSURES required the positive displacing action of conventional reciprocating pumps plus the flexibility of capacity provided by centrifugals. And Aldrich Engineers knew the answer — the Aldrich-Groff Controllable Capacity "POWR-SAVR" Pump.

STEPLESS STRAIGHT LINE CONTROL OF CAPACITY, from zero to rated maximum output, was possible with the "POWR-SAVR". Pump delivery was automatically controlled to suit varying requirements and power consumption became nearly proportional to the rate of output, affording desirable power savings.

SURGE TANKS WERE ELIMINATED, due to the "POWR-SAVR's" ability to meet immediate changing line conditions. This eliminated associated evaporation losses, co-mingling of different batches, and much of the danger of handling highly flammable material. Gone, too, was the need for bypassing to handle excess quantities of pump output.

UPRIGHT DESIGN of the "POWR-SAVR" places discharge valves directly over the plungers and inlet valves at one side. Efficient valve action permits the pump to operate at the high rate of 240 rpm. Another design feature was the use of porcelain plungers, reducing packing and leakage troubles.

THE ALDRICH PUMP COMPANY has been solving the difficult pumping problems of American industry since 1902. We've never turned down a challenge — many of yesterday's tough pumping problems are today routine.

DATA SHEET 65A, describing the Aldrich-Groff Controllable Capacity "POWR-SAVR" Pump will be sent to you on request. Or our representative will be glad to call. Address your request to: The Aldrich Pump Company, 9 Gordon Street, Allentown, Pa.

Aldrich-Groff Controllable Capacity "POWR-SAVR" Pump suitable for pumping butane and other light-gravity fluids.

...for your tough pumping problems specify ALDRICH

This machine is ideal for pumping light-gravity fluids at medium and high pressures. It combines features of superior efficiency and positive displacing action of reciprocating pumps with the flexibility of capacity of centrifugal pumps. A unique, reliable mechanism controls the plunger-stroke from zero to rated output without change of speed of power source, providing desired savings in power plus top efficiency.

Typical Applications for the Aldrich-Groff "POWR-SAVR" Pump:

Pipe Line Service	Process Charging
Boiler Feeding	Oil-burner Supply

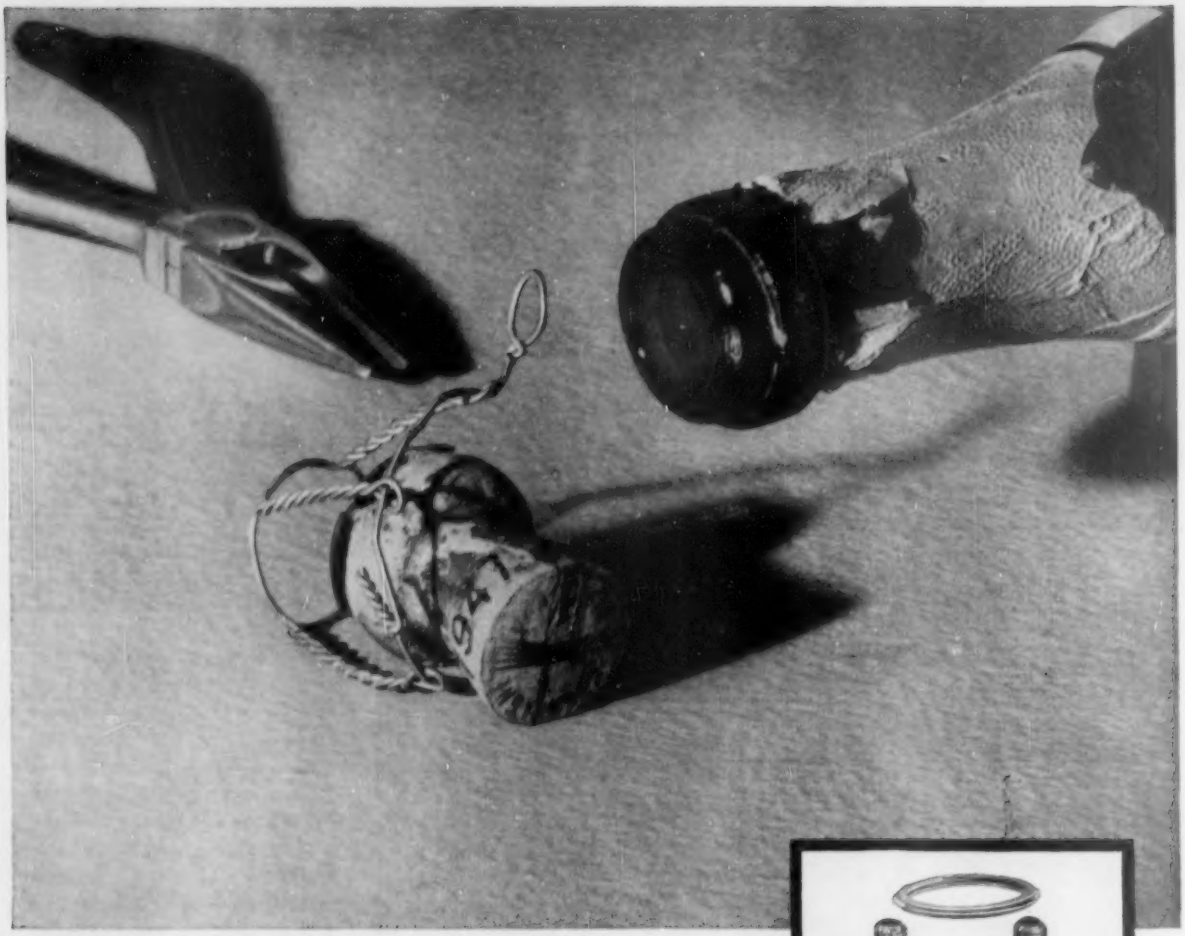
Write for Data Sheet 65A, describing the features of the "POWR-SAVR" Pump. Or, if you prefer, our representative will be glad to call.

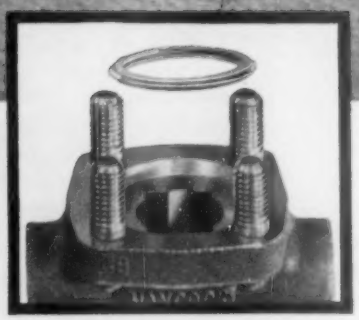
THE ALDRICH PUMP COMPANY

Originators of the Direct Flow Pump

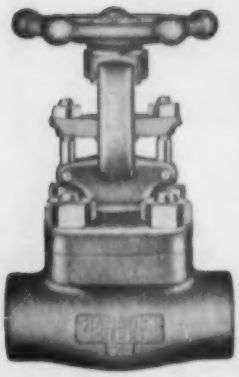
9 GORDON STREET
ALLENTOWN, PA.

Representatives in principal cities





SEAL-ABILITY
that prevents blowouts



THE FLEXITALLIC GASKET creates a positive, pressure-tight seal in the bonnet joint of the Type 950 Hancock Steel Gate Valve. It is a spiral-wound ribbon of stainless steel with asbestos filler and spring-like compressibility. The gasket can be reused – cannot be flattened as the flanges which retain it form an integral compression gauge. Because the gasket rests in a groove in the body flange, it cannot blow out *even if pressures exceed ten times the rating of the valve.*

Only a specially-designed bonnet joint can fully utilize the tremendous sealing power of the Flexitallic gasket. And, advanced engineering proves that an investment in Hancock quality pays dividends in trouble-free performance. Let your nearby Industrial Supply Distributor explain fully. Phone him today.

HANCOCK VALVES

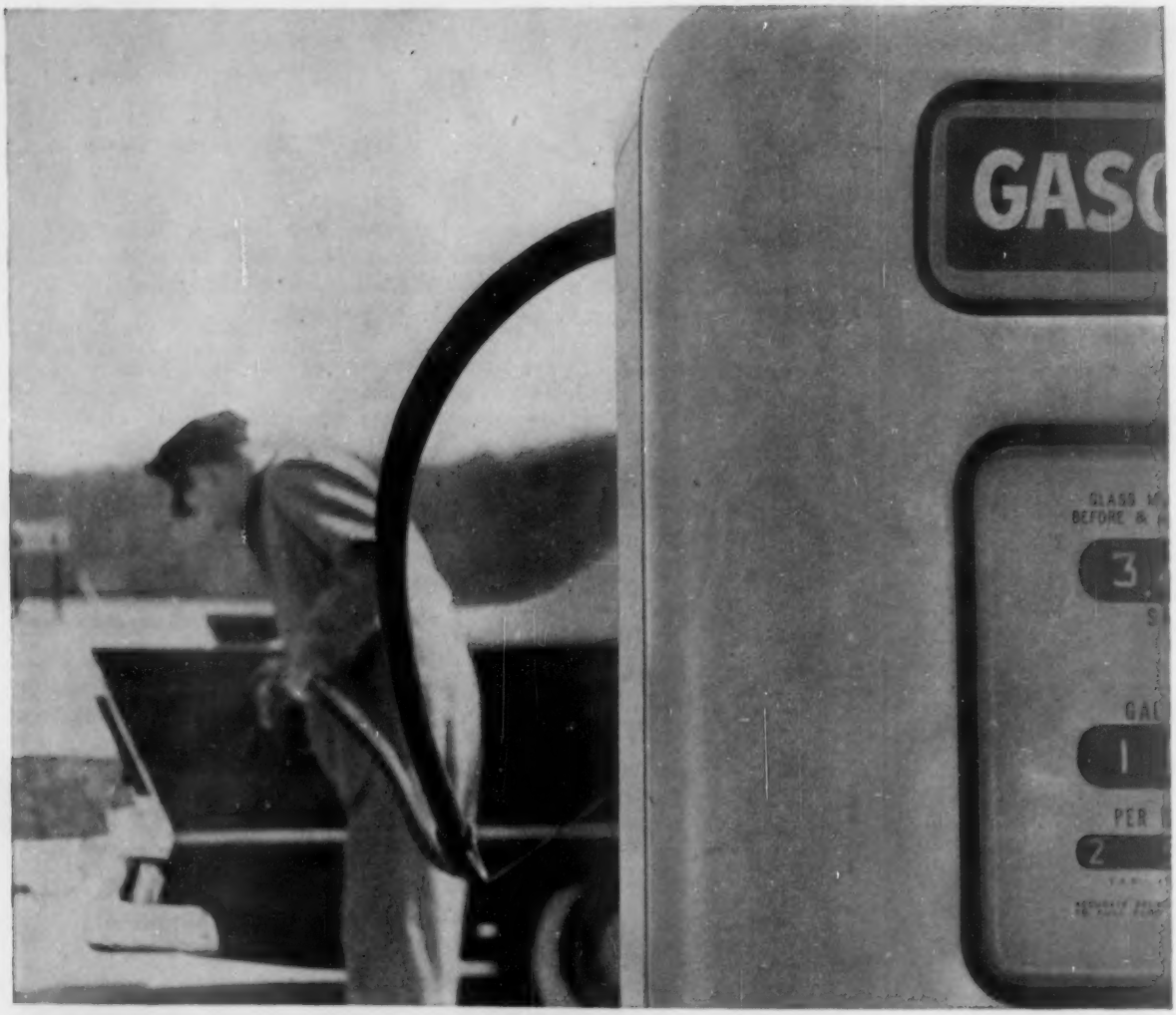
A product of

MANNING, MAXWELL & MOORE, INC.

Watertown 72, Massachusetts

In Canada: *Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario*

Do You Know This Man?
He is your Mid-Continent Supply Company field salesman . . . representative of hundreds of experienced Mid-Continent oil field men who serve you around the clock.
The warmth and friendliness in this genial salesman's face typify the spirit of helpful service and integrity that has helped make Mid-Continent the world's largest independent oil field suppy organization.
Mid-Continent men are setting a high standard of service for the supply industry wherever there is oil.
MID-CONTINENT SUPPLY CO.
MID-CONTINENT
Supply Company
MID-CONTINENT BLDG. FORT WORTH, TEXAS
THE WORLD'S LARGEST INDEPENDENT OIL FIELD SUPPLY COMPANY



NEW submersible pump motor!

LELAND announces a new, fully U. L. Approved 60-cycle pump motor that prevents vapor-lock!

New, higher octane, more volatile gasolines pose a serious problem of vapor-lock. Or *did*. For Leland has developed a completely new submersible pump motor that allows both motor and pump to be placed right *in* the gasoline storage tank.

Leland's new explosion-proof pump motor actually uses gasoline itself for both lubrication and cooling . . . installs in existing tanks. In development and under field test for more than six years, it represents as great a step forward as did the *first* gasoline curb pump motor to receive U. L. Approval—developed by Leland over 30 years ago.

There's good reason why Leland gasoline pump motors *outsell all others combined* . . . why for explosion-proof motors of any kind, your best move is to Leland. Write, wire, or phone us today.

Leland's new 60-cycle submersible gasoline pump motor, ¾ hp, 230 V, 3450 rpm, only 3½" in dia., 17" long.

Another AMF Product

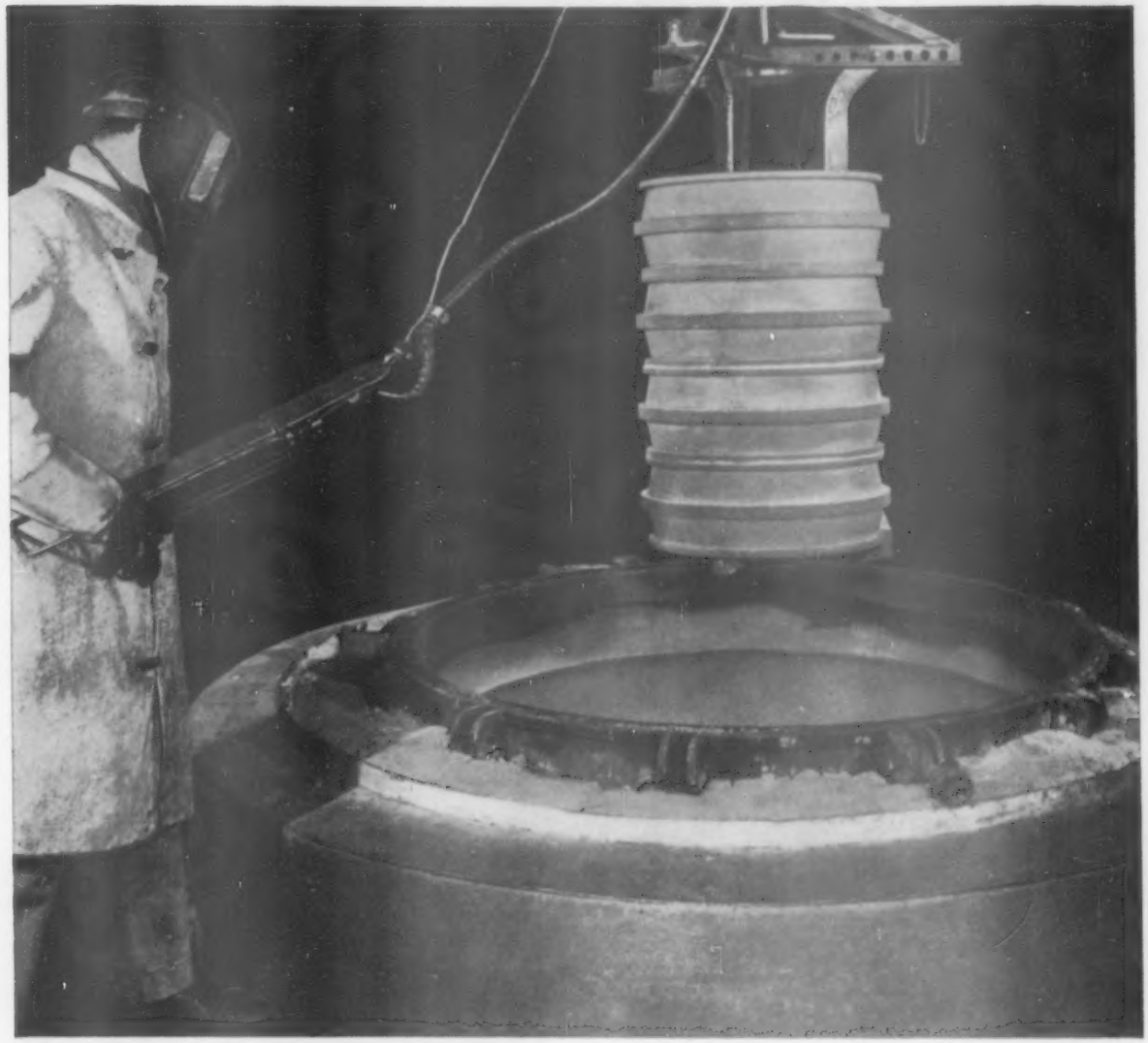
LELAND MOTORS

THE LELAND ELECTRIC COMPANY

Dayton 1, Ohio

Division of AMERICAN MACHINE & FOUNDRY COMPANY

TORRINGTON BEARINGS



Heat treating makes the difference!

At Torrington we're as fussy with heat treating a bearing as an expert chef is about a charcoal-broiled tenderloin. No wonder TORRINGTON BEARINGS last long and give dependable service wherever they are used.

For out of TORRINGTON'S advanced heat-treating facilities come races and rollers that are consistently hard . . . stable . . . uniform. Quality of steel is important and that's carefully controlled, too. Only the finest bearing quality steels—case-hardening or through-hardening grades—are used in manufacture.

At the Bantam Bearings Division, we make all types of bearings for heavy duty application—Spherical Roller, Tapered and Cylindrical Roller, Heavy Duty Needle, Ball and various types of thrust bearings.

Make sure you specify TORRINGTON. Our many basic types of anti-friction bearings are backed by custom engineering to meet your speed and load requirements. For special jobs, your TORRINGTON engineer will be happy to select or help design the best bearing for you. Call him today!

THE TORRINGTON COMPANY
South Bend 21, Ind. • Torrington, Conn.
District offices and distributors in principal cities of United States and Canada

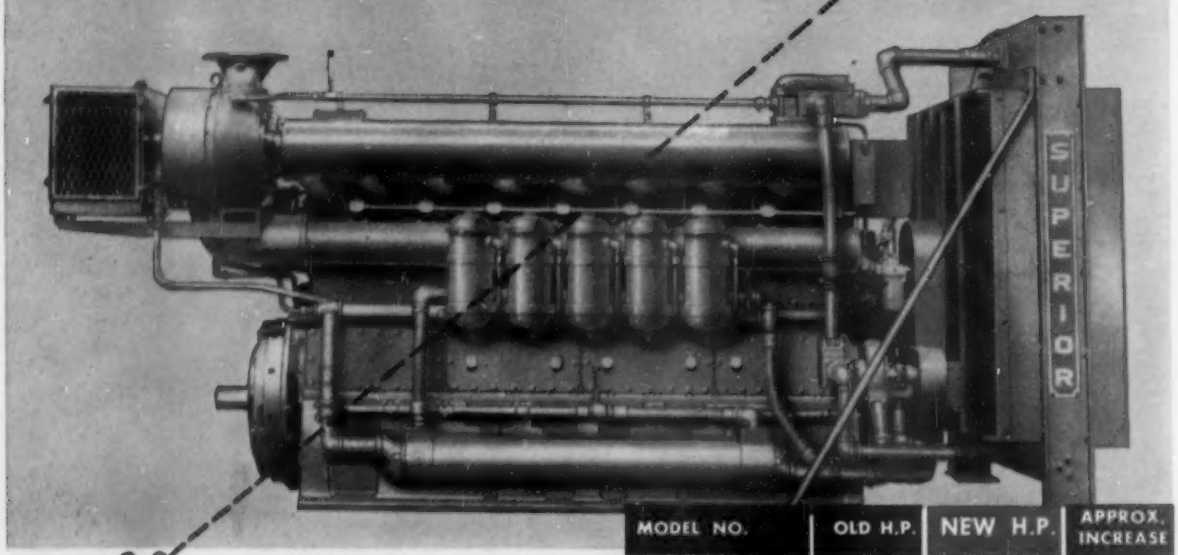
TORRINGTON BEARINGS

Spherical Roller • Tapered Roller • Cylindrical Roller
Needle • Ball • Needle Rollers

White's NEW SUPER PTD gives you

30% MORE POWER*

. . . and more cost-saving features!



MODEL NO.	OLD H.P.	NEW H.P.	APPROX. INCREASE
Super PTD-6	280	364	30%
Super PTD-8	375	485	29%
Super PTDS-6	460	560	22%
Super PTDS-8	620	750	21%

*CONTINUOUS WORKING HORSEPOWER

Maintaining Superior's conservative rating. Including fan and all other accessories. Continuous at 900 RPM. No correction necessary to 1500 feet elevation and 90° F.

Now, White's newly improved Super PTD Diesels give you even more drilling engine advantages than ever before! You get greater power with no increase in size . . . resulting in less weight and less cost per horsepower! You get greater working ability . . . more lugging power for easier hoisting, and faster acceleration for quicker round trips and for fast pipe handling. They have plenty reserve power too for emergencies, and enable you to get more power from fewer engines on multiple engine rigs.

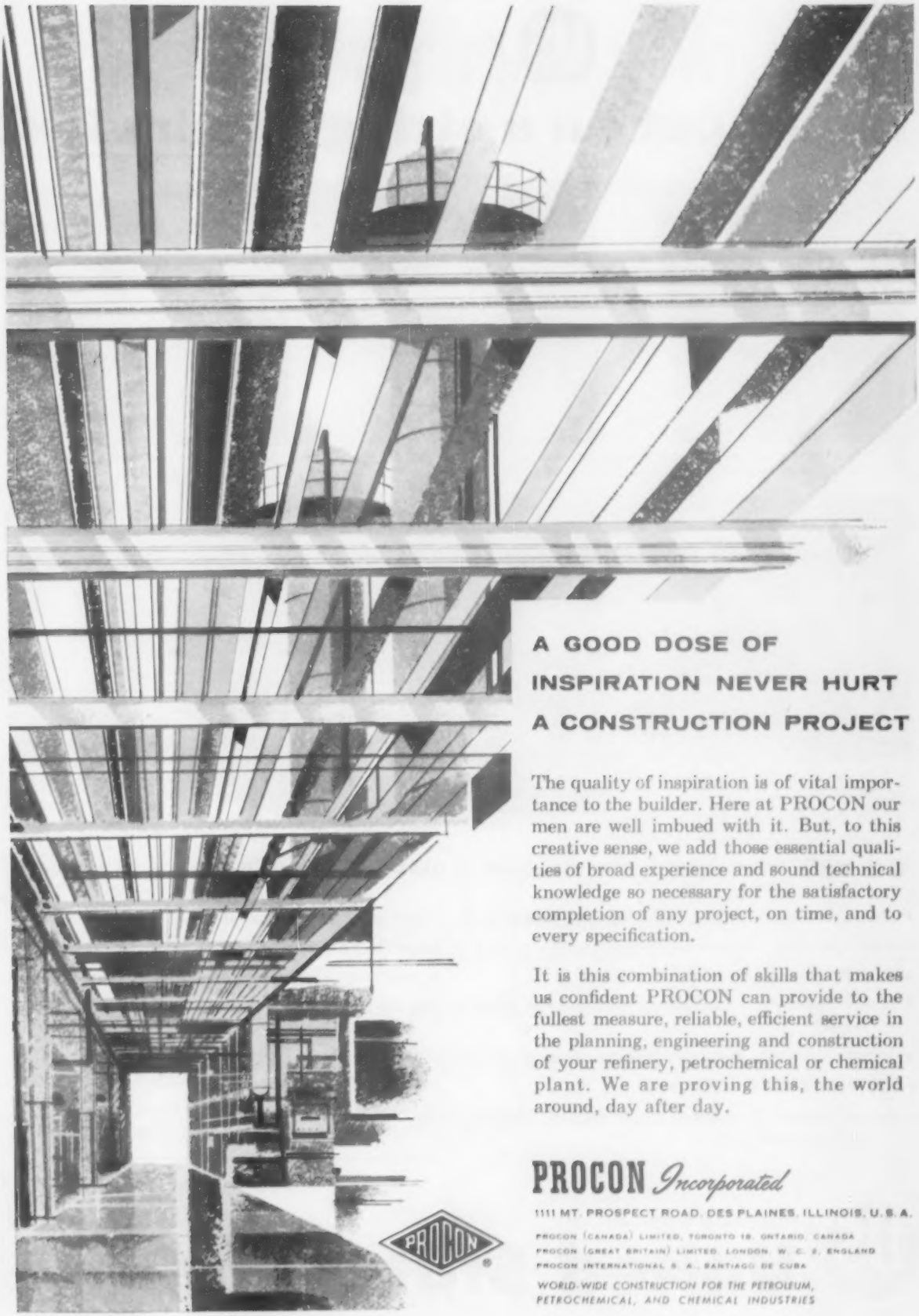
Super PTD's provide power comparable to other engines having more cylinders . . . thus, the more simple design with fewer cylinders and internal parts offers outstanding advantages in requiring fewer replacement parts and lower maintenance and repair costs.

White's new design and engineering advances have also achieved even greater dependability, smoother operation, increased engine life and highly improved engine efficiency. Get all the facts from leading rig manufacturers, or through White Diesel representatives available in all oil field areas, or through White Diesel Engine Division.

Superior ENGINES · ATLAS Imperial DIESEL ENGINES · White DIESEL

WHITE DIESEL ENGINE DIVISION

THE WHITE MOTOR COMPANY • *Plant and General Offices: Springfield, Ohio*



A GOOD DOSE OF INSPIRATION NEVER HURT A CONSTRUCTION PROJECT

The quality of inspiration is of vital importance to the builder. Here at PROCON our men are well imbued with it. But, to this creative sense, we add those essential qualities of broad experience and sound technical knowledge so necessary for the satisfactory completion of any project, on time, and to every specification.

It is this combination of skills that makes us confident PROCON can provide to the fullest measure, reliable, efficient service in the planning, engineering and construction of your refinery, petrochemical or chemical plant. We are proving this, the world around, day after day.

PROCON *Incorporated*

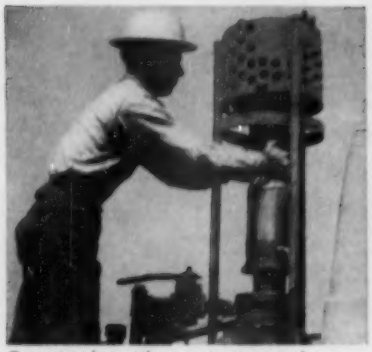
1111 MT. PROSPECT ROAD, DES PLAINES, ILLINOIS, U.S.A.

PROCON (CANADA) LIMITED, TORONTO 18, ONTARIO, CANADA
PROCON (GREAT BRITAIN) LIMITED, LONDON, W. C. 2, ENGLAND
PROCON INTERNATIONAL S. A., SANTIAGO DE CUBA

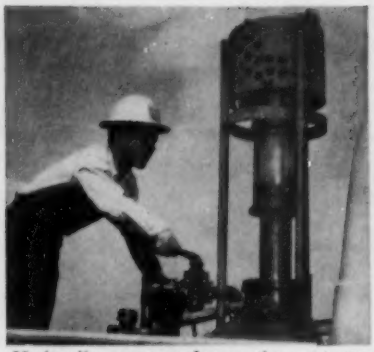
WORLD-WIDE CONSTRUCTION FOR THE PETROLEUM, PETROCHEMICAL, AND CHEMICAL INDUSTRIES

US RUBBER Pipe Protectors

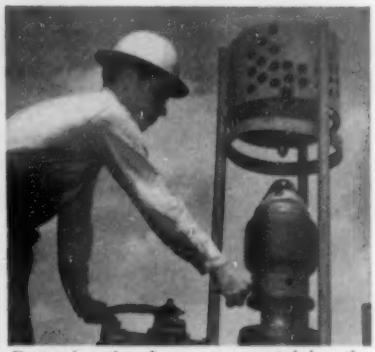
...are put on a string in minutes!



Operator is putting protector on the cone for expansion over the sleeve.



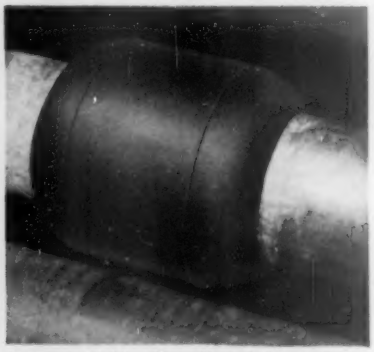
Hydraulic pressure forces the protector from the cone onto the sleeve.



Removing the sleeve now containing the expanded protector.

Slipping the sleeve and the protector over the pipe collar.

Protector is "kicked off" sleeve onto pipe. Note light delivery truck where second man is preparing another protector.



Sleeve quickly slips off and the protector fits tight to the drill pipe.

U. S. Pipe Protectors are the *best* protection for drill pipe and casing

- stop tool joint wear and prevent injury to casing
- lower vibration, reduce friction and torque
- simplify deep and crooked well drilling
- reduce twist-offs, "soft pipe" troubles and line "whip"
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- can be used in any kind of mud
- can be successfully removed and re-applied... after use in oil-base muds
- anti-swirl end design prevents "pipe-ringing"
- solidly molded of a special neoprene compound
- made to fit every size drill pipe and casing condition

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Coming Soon—New *Blue* Pipe Protectors for extra high pressures encountered below 18,000 feet.

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AMAZING NEW DEVELOPMENT

in perforating is here NOW!

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A completely NEW DEVELOPMENT which gives

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- **BETTER CLEANOUT**
- **IMPROVED DRAINAGE**
- **HIGHER FLOWRATES**

FOR A PHOTOGRAPH OF SOMETHING YOU NEVER SAW BEFORE — TURN THE PAGE

This is the TWO QUARTS of DEBRIS retained in the gun from one firing of a 24-shot "KARROTFREE" KONESHOT gun

ONLY

LANE-WELLS

"KARROTFREE" KONESHOT

SERVICE

prevents this debris from plugging your perforations—

brings it back out of your well!

Plugging has long been recognized as a major problem in shaped-charge perforating. Recent independent research by the oil companies points to plugging as an important factor in sanding, lowered flowrates, loss of otherwise recoverable reserves, and in producing misleading reservoir information.

But now this problem—extremely difficult because of the tremendous forces released by shaped-charge perforating—has been solved! After long development and testing, Lane-Wells has found the way to prevent shaped-charge debris from being fired into the formation. Debris—which could cause plugging and formation damage—is held and brought to the surface. *When it's out of your well, it can't plug your perforations!*

That, in brief, is the story of Lane-Wells "Karrotfree" Koneshot Shaped-Charge Perforating Service

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A PROGRESS REPORT ON OILMASTER DUAL ZONE PUMPING EQUIPMENT

Until about four years ago, when our customers asked us about pumping two zones from the same well bore, we told them to forget it and drill a second well. However, with economics strongly favoring the dually completed single well, we were forced to change our minds.

The first Oilmaster Dual Zone pumping hookup was run in May 1953. It worked, but it fell short of being the tool we wanted. It did, however, point up the importance of having trained men in the field to design and supervise installations, and to assist in a program of research and development. A special division was formed, the tools were redesigned, and the product gained customer acceptance. This newly created Technical Service Division has been expanded as required to pace the increased demand of a broadening market.

Many changes have been made in the Oilmaster Dual Zone Pumping Equipment since 1953. The current models are less complicated—easier to run—easier to repair, and less expensive than old number one. But the biggest change has been in the diversity of models to handle varied pumping conditions. *Now it is possible to offer the producer every control in a dual well that is possible in a single well, including separating gas or treating paraffin or corrosive fluid in either or both zones.*

Want to hear more? Contact your nearest Oilmaster Representative or write Fluid Packed Pump Co., Box 64, Los Nietos, California, for complete information.

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They Say—

Imports Fill a Need

"Stated briefly, the U. S. petroleum situation today involves the balancing of rapidly increasing consumption against available production and reserves. And yet domestic reserves are increasing at a relatively slow rate.

"Therefore, it is vital that our import policy must be one that will actively encourage the maximum practicable effort toward oil exploration here at home through the use of constantly improving techniques in discovery and production. At the same time we must not forget that in the years to come we will probably require appreciable quantities of petroleum from friendly countries elsewhere . . .

"Military authorities tell us that if a war emergency be thrust upon us we would need oil wherever we can obtain it, in both the Western and Eastern Hemispheres. In times of peace our oil imports help to maintain vigorous petroleum industries and strong economics abroad, which in turn increase the strength of the free world and strongly resist the efforts of those who would destroy the institutions we believe in.

"We must at the same time face the fact that today flush, low-cost oil from some areas of the world can be laid down in the United States more cheaply than it can be found and produced domestically.

"The need to draw on foreign sources of supply to meet our expanding demand is recognized as inevitable by many authorities . . . Our chief problem in the U. S. in this connection is that of maintaining a proper balance between imports and domestic oil production . . .

"It is probable that the rapid increase of demand will require that the U. S. import appreciable quantities of oil in the years to come. I believe that this can be done without endangering the basic prosperity of our domestic fuels industries.

"This does not mean, however, that there will not be many complex and difficult problems ahead. By maintaining flexibility to meet changing circumstances, and a willingness to work through the voluntary, individual methods of free enterprise, I believe that they can be surmounted. This will require statesmanship on the part of the industry and the full cooperation of all of the state and federal agencies, of which the state regulatory commissions and the Interstate Oil Compact Commission can play a major part.

"Our country has been built upon the foundation of a competitive and voluntary system of free enterprise. Controls often seem like an easy panacea for our problems, but once started they are hard to stop. Freedom from unnecessary regimentation is the American way, and the fact that the problems ahead are complex and difficult is no reason why we should be unwilling to tackle them in the American way."

Herbert Hoover, Jr., under secretary of state, in address before the Dallas meeting of Interstate Oil Compact Commission.

Merger Bill Assailed

"No oil operator can be certain as to whether a sale or farmout of his leases falls within or without the coverage of the (merger control) bill. Even if this could be fairly well determined, a change in operations could effectively change a factual determination or the believed exclusion to inclusion under this bill, with retroactive effect in twilight situations.

"TIPRO is in full accord with the motives of this bill in preventing good

TC

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Fe	.04% maximum
Zn	.01% maximum
Copper Exychloride—less than	.50% maximum

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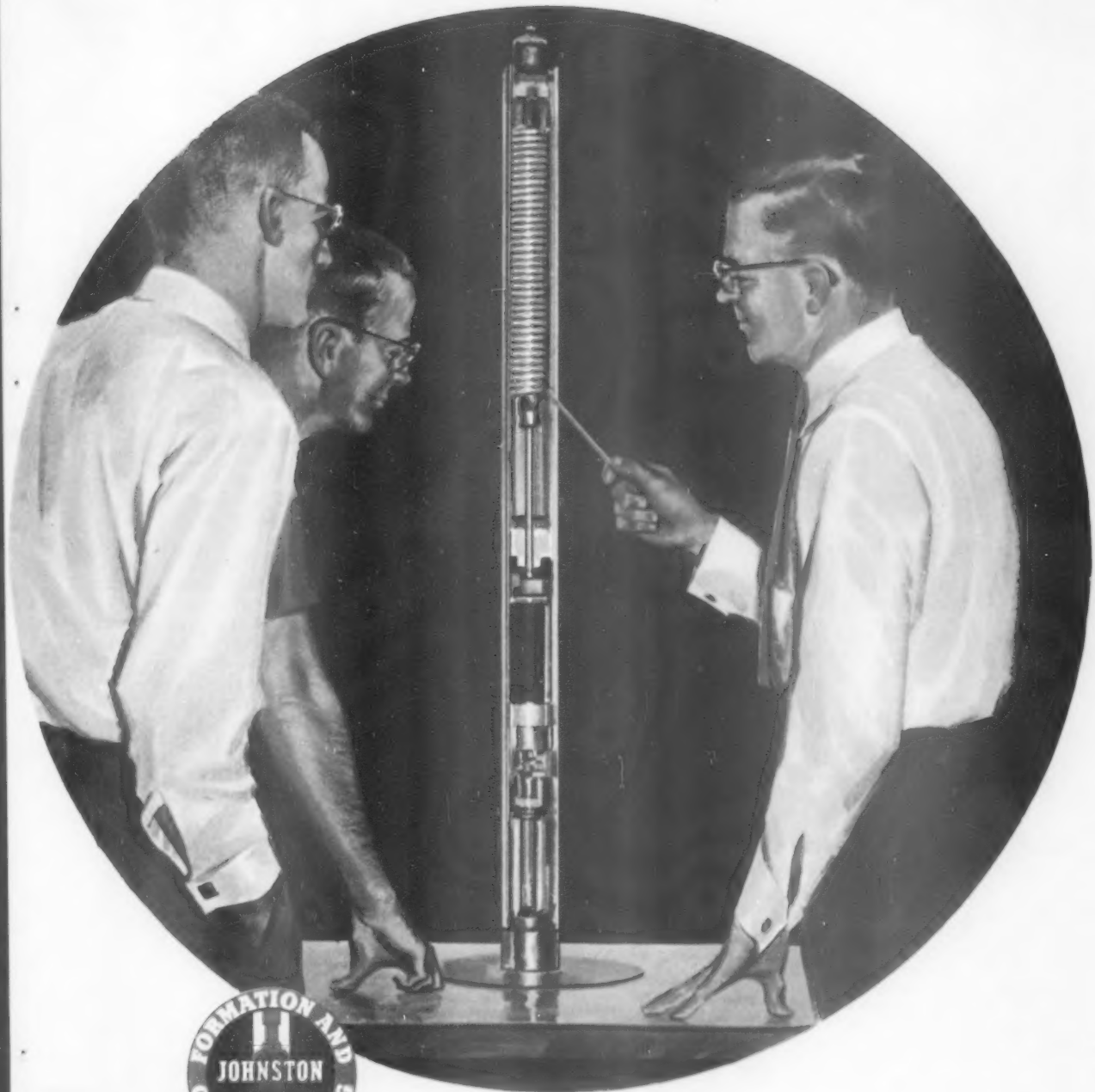

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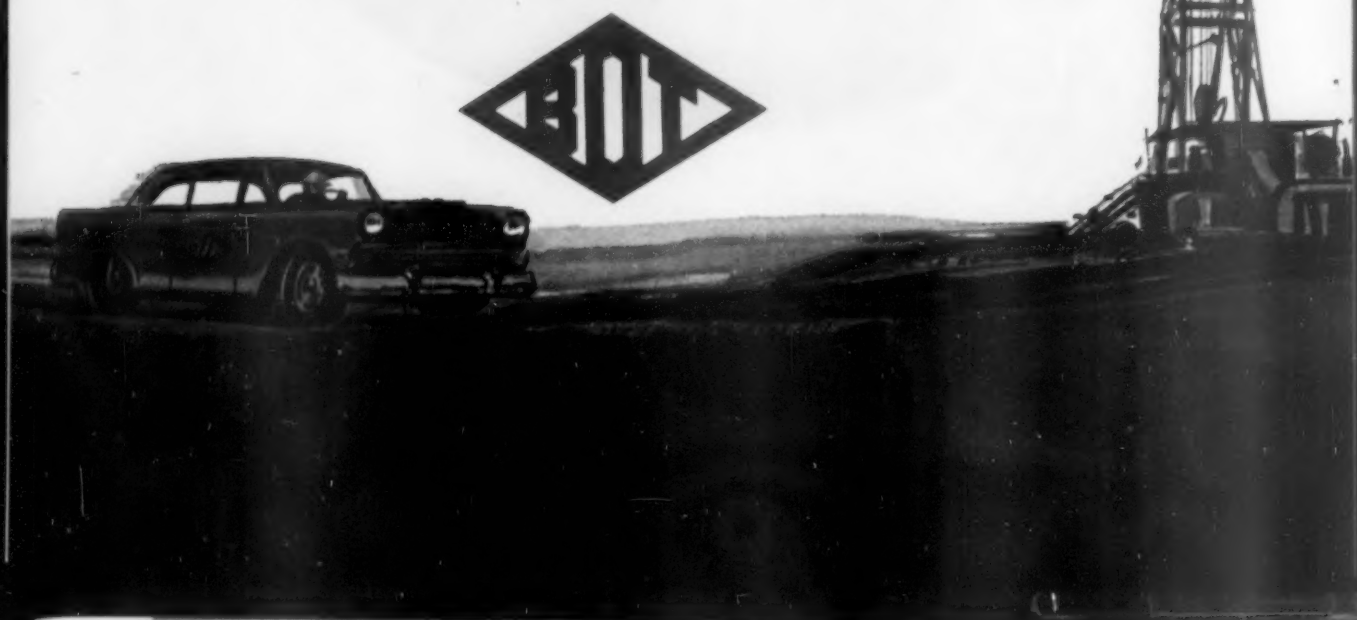


purposes without attendant harassment to independent operators."

Elton M. Hyder, Jr., attorney for Texas Independent Producers and Royalty Owners Association, testifying before Senate subcommittee considering merger bill.

The Trans-Canada Battle

"To a superficial observer from outside it may seem surprising that in promoting the Trans-Canada Pipeline Assistance Bill the Liberal Government at Ottawa, secure with an immense majority after 20 years of office, should have stirred up the greatest parliamentary storm since the war.

"Is not the pipeline a most promising project for the mutual good, which will enable Alberta to profit by selling its vast stores of natural gas to the power-hungry industries of the eastern provinces?

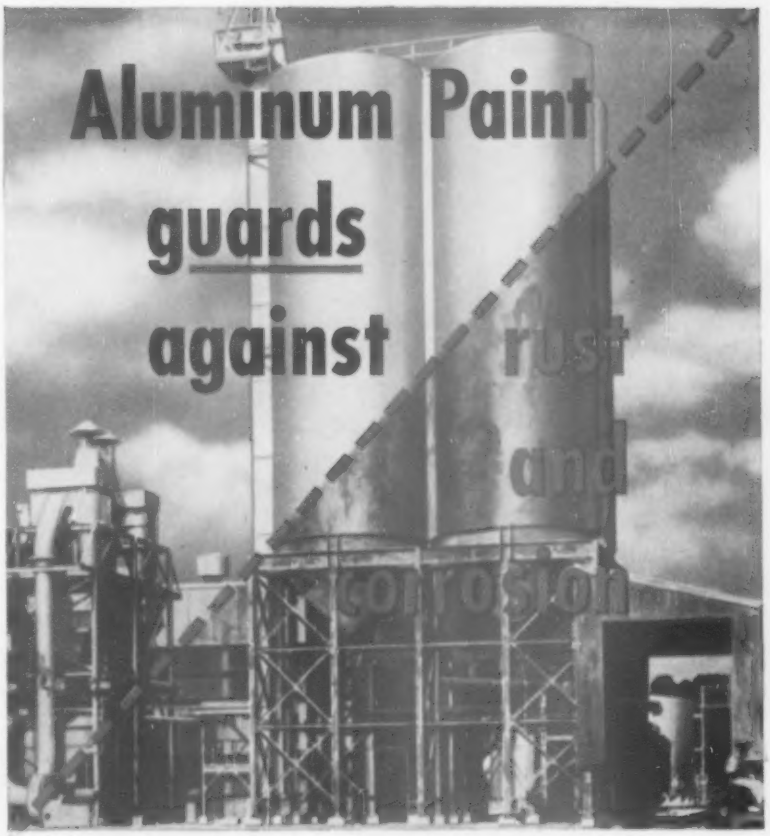
"The circumstances of the undertaking, however, have mobilized against it the strongest opposition of both Socialist doctrine and nationalist sentiment.

"The project began with private enterprise. Trans-Canada Pipelines, Ltd., which originated the plan, is controlled by three large companies in the United States. Their resources, however, were not equal to providing the full capital of about £135,000,000, and they appealed to the Canadian Federal Government for help, which was eventually arranged in conjunction with the provincial government of Ontario.

"There followed determined resistance before the Federal Power Commission in the U. S. by American companies that objected to the importation of competing Canadian gas; and at the same time the Opposition parties in Canada plunged into the fray against the enabling legislation.

"The Progressive Conservatives and the (Socialist) Cooperative Commonwealth Federation were drawn into unnatural alliance. C.C.F. stood for the wholehearted principle of nationalization. Mr. Coldwell, the leader of the party, maintained that the government should not only build the pipeline but own and operate it. For the rest, he supported the whole range of the attack by Mr. Drew, the Progressive Conservative, which was directed mainly against the American investment in the scheme.

"Mr. Drew has a good deal of ammunition for his campaign against any increase in American financial power in Canada. Recent figures published by the Federal Bureau of Statistics show that in 1955 American capital controlled 45 per cent of the manufacturing plants in Canada, 70 per cent of



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Inside your plant and out, good aluminum paint actually puts a *protective* shield on rustable metal and masonry surfaces. Usually a single coat is all that's required; and one coat lasts and lasts. You cut maintenance costs, get extra protection.

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*U.S. Patent 2701772

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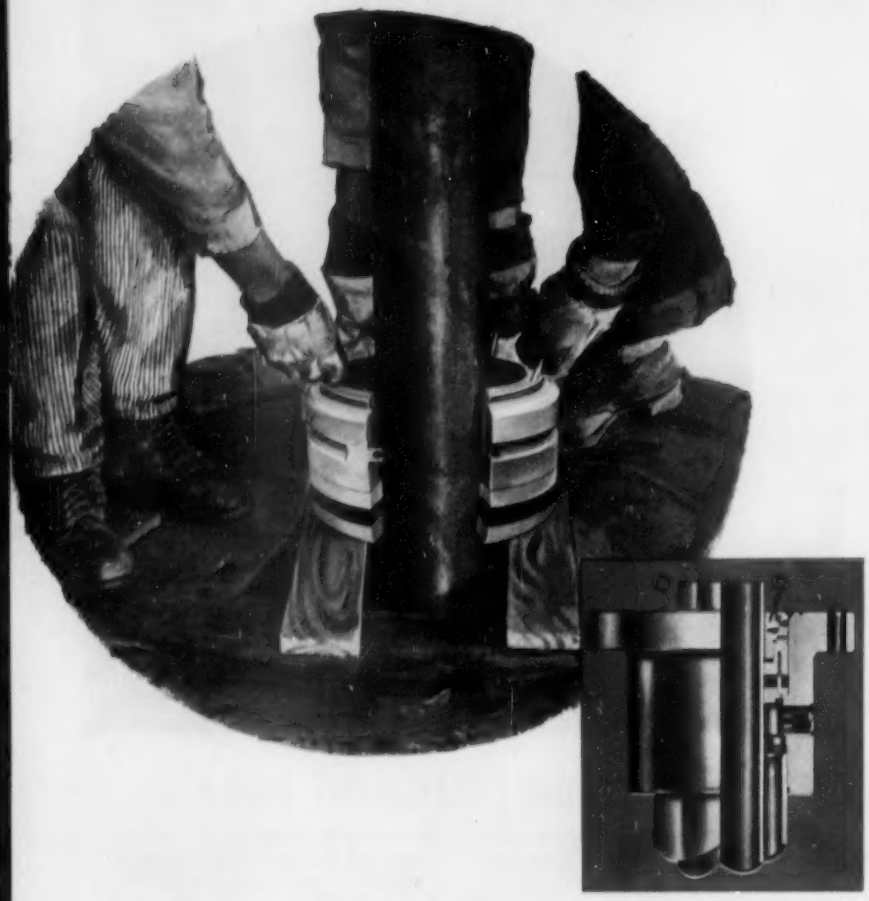
THE O·C·T C-20 CASING HEAD



lets you work in *Safety*

Regardless of how or when you decide to install the O-C-T "C-20" Casing Hanger . . . before cementing, after cementing, through preventers, under preventers, or at any time in case of stuck pipe . . . you can improve the safety of your completion operations and save hours of expensive rig time due to the flexible, simplified O-C-T installation procedure.

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The first quick-setting, positive-sealing well head designed especially to eliminate open hole hazards in medium depth wells, the O-C-T "C-20" Casing Hanger can't forget to seal . . . because the sealing element, slip bowl and slips are assembled as a single unit that may be wrapped quickly around the casing, latched and dropped into place, eliminating the possibility of individual parts being installed incorrectly.

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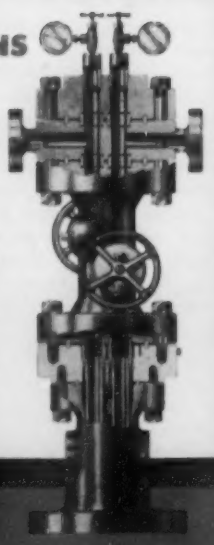
This compact Oil Center Tool Company Christmas Tree assembly provides a safe, strong and practical means to economical dual completions.

If you are considering dual completions, it will pay you to check the features and get the full story of this O-C-T Dual Completion Assembly.



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the oil industry, and 55 per cent of the mines.

"'We are not,' says Mr. Drew, 'going to be treated as if we were the fiftieth state of the Union. We are not going to be hewers of wood, drawers of water, and diggers of holes for any other country, no matter how friendly that country may be.'

"Such is the background to the stormy debates on Parliament Hill. Against the misgiving alike of nationalists and nationalizers there is a strong case to be made out for the solid industrial value of the scheme."

Editorial in London Times.

Prices Can Only Go Up

"Costs of finding, producing, transporting, refining, and distributing petroleum are increasing, so prices in the long-term can only move in one direction, and that is up. Fuel oil prices will be no exception. Nevertheless, petroleum will continue to be the best buy in the market-place."

Rexford S. Blazer, president of Ashland Oil & Refining Co., in address before convention of National Association of Purchasing Agents, Cleveland.

Importers Disputed

"Present conditions in the domestic oil industry call for an immediate adjustment in crude-oil prices to cover the increases in wages and higher prices of steel and other materials.

"Some importing company officials who argue against an oil-price adjustment on the basis that the supply situation does not justify an increase are mixing cause and effect.

"If over-supply is a factor, it is an import problem and not a domestic situation. National welfare and security require that domestic oil supplies be expanded. In the face of surplus foreign oil and higher costs, domestic producers are being denied the funds for expansion.

"A continuation of these conditions would lead inevitably to the liquidation of the oil producing industry in the United States."

Robert L. Wood, president of Independent Petroleum Association of America, in public statement.

Who Regulates Oil?

"Somewhere in this continuing struggle the line must be drawn. It is the duty of the official states (of the Compact Commission) to consider—and to consider very carefully—the growing peril to the basic police power of states to regulate the development and production of oil and gas . . .

The Compact issues no rules and regulations, and never has. It is a com-

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OKLAHOMA NATURAL GAS COMPANY MAINTAINED GAS SERVICE TO OKLAHOMA CITY CUSTOMERS WHILE RELOCATING A SECTION OF PIPELINE CROSSING THE NORTH CANADIAN RIVER . . .

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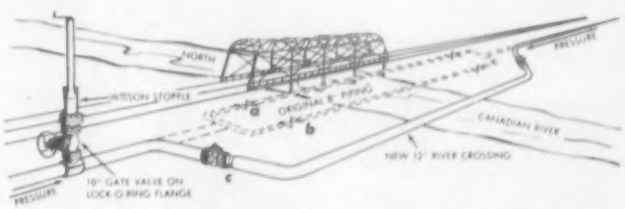

② TAP WAS MADE WITH WmSON-HILLCO MODEL 660 TAPPING MACHINE

③ WmSON STOPPLE REPLACED TAPPING MACHINE ON CLOSED VALVE

④ LINE WAS PLUGGED ISOLATING SECTION BETWEEN STOPPLE AND VALVES a. & b. (CITY LOOP SYSTEM MAINTAINED SERVICE TO RIVER FROM EACH SIDE.)

⑤ ISOLATED SECTION WAS THEN CUT AND NEW 12" CROSSING TIED INTO 10" LINE

⑥ FOR REMOVAL OF VALVE, LOCK-O-RING PLUG WAS INSTALLED IN L-O-R FLANGE WITH TAPPING MACHINE

⑦ TAPPING MACHINE AND GATE VALVE WERE REMOVED AND BLIND FLANGE INSTALLED

THIS ENTIRE OPERATION WAS THEN REPEATED ON THE OPPOSITE SIDE OF THE RIVER

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pletely powerless body, and has never made even a tentative pass at any suggestion that it be given documented powers . . .

"Actually, the Compact has no authority whatsoever over the compacting states. The States pass and enforce their conservation laws pursuant to their own police power, which in turn is derived from their inherent sovereignty and because it is reserved to them under Article 10 of the Constitution of the United States."

Gov. John F. Simms of New Mexico in chairman's report to Interstate Oil Compact Commission, Dallas.

Companies Have Character

"To be successful today a company certainly must be competitive product-wise—there will never be a substitute for that. But, as never before in our history, it must also be known as a company with character—one that deals fairly, that looks ahead, that thinks in terms of service first and profit second.

"This is so because as our economy has expanded, corporations have emerged not merely as efficient means of producing and distributing commodities, but as symbols of a whole way of life. They have become social, as well as economic, institutions whose daily operations have immediate impact upon hundreds of thousands of people — customers, employes, stockholders, dependent business enterprises, even Governments."

James H. Pipkin, vice president, The Texas Co., in address before International Distribution Congress, Chicago.

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CALENDAR OF EVENTS

JUNE

21-22 Western Petroleum Refiners Association, regional technical—industrial relations meeting, Broadview Hotel, Wichita.

21-23 American Association of Petroleum Landmen, annual convention, Denver.

25-29 American Institute of Electrical Engineers, 1956 summer and Pacific general meeting, San Francisco.

26-29 Canadian Gas Association, Manoir Richelieu, Murray Bay, Que.

28-30 Rocky Mountain Oil and Gas Association, board of directors, Hotel Utah, Salt Lake City.

JULY

9-11 American Gas Association, American Petroleum Institute, Canadian Petroleum Association, committees on natural gas reserves, Banff, Alta.

17-27 Program on Recent Advances in Catalytic Polymerization, Massachusetts Institute of Technology, Cambridge, Mass.

18-20 Yellowstone-Bighorn Research Association, third Professional Short Course on Uranium Occurrence and Structural Geology, Red Lodge, Mont.

AUGUST

2-4 Rocky Mountain Mineral Law Foundation, Second Annual Institute, University of Colorado, Boulder.

20-21 North Dakota Oil and Gas Association, annual meeting, Bismarck, N. D.

27-29 Sixteenth Annual Gas Measurement Short Course, West Virginia University, Morgantown, W. Va.

SEPTEMBER

5-7 Wyoming Geological Association, eleventh annual field conference, Jackson Lake Lodge, Moran, Wyo.

9-12 Independent Natural Gas Association of America, annual membership meeting, St. Anthony Hotel, San Antonio, Tex.

11-13 Pacific Coast Gas Association, annual meeting, Coronado, Calif.

12-14 National Petroleum Association, annual meeting, Traymore Hotel, Atlantic City, N. J.

13-15 Chemical Institute of Canada, third Western Regional Conference, Edmonton, Alta.

16-18 New Mexico Petroleum Industries Committee, annual convention, Hilton Hotel, Albuquerque.

16-21 American Chemical Society, 130th annual meeting, Atlantic City, N. J.

16-21 American Society for Testing Mate-

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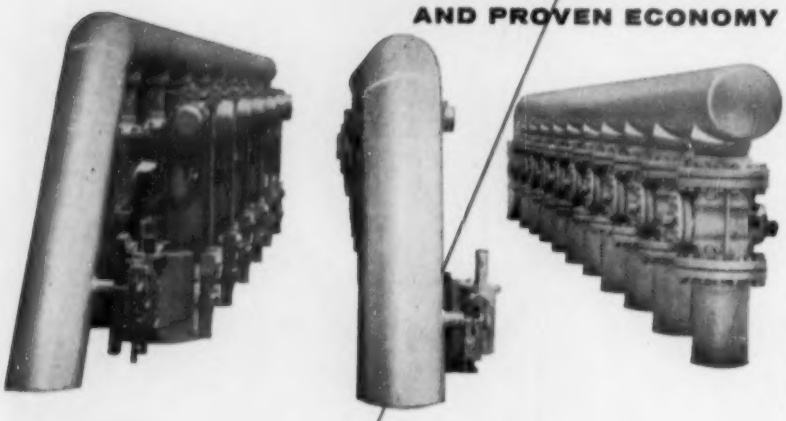

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rials, Second Pacific Area National Meeting, Statler Hotel, Los Angeles.

17-21 Instrument Society of America, eleventh annual international instrument-automation conference and exhibit, New Coliseum, New York City.

20-21 Western Petroleum Refiners Association, regional technical-industrial relations meeting, Hotel Henning, Casper, Wyo.

20-21 Mid-Continent Oil and Gas Association, Louisiana-Arkansas division, annual membership meeting, Roosevelt Hotel, New Orleans.

24-26 American Society of Mechanical Engineers, petroleum mechanical engineering conference, annual meeting, Statler-Hilton Hotel, Dallas.

26-28 Rocky Mountain Mineral conference, American Institute of Mining, Metallurgical & Petroleum Engineers, Newhouse Hotel, Salt Lake City.

OCTOBER

2-3 Texas Mid-Continent Oil and Gas Association, thirty-seventh annual meeting, Rice Hotel, Houston.

2-4 National Association of Corrosion Engineers, south central region, Beaumont.

7-9 American Association of Oil Well Drilling Contractors, annual meeting, Texas Hotel, Fort Worth.

11-12 California Natural Gasoline Association, fall meeting, Sheraton Hintington Hotel, Pasadena, Calif.

14-17 American Institute of Mining, Metallurgical & Petroleum Engineers, Petroleum Branch, fall meeting, Biltmore Hotel, Los Angeles.

14-20 OIL PROGRESS WEEK.

15-17 American Gas Association, annual meeting, Atlantic City, N. J.

18-19 Western Petroleum Refiners Association, regional technical-industrial relations meeting, Rufus Garrett Hotel, El Dorado, Ark.

18-21 Permian Basin Oil Show, Odessa, Tex.

22-24 Rocky Mountain Oil and Gas Association, annual convention, Cosmopolitan Hotel, Denver.

29-30 Illinois Geological Survey, Petroleum Engineering Conference on Waterflooding, University of Illinois, Urbana, Ill.

29-Nov. 1 Society of Exploration Geophysicists, annual meeting, Roosevelt Hotel, New Orleans.

NOVEMBER

7-8 Philadelphia section, Instrument Society of America, Symposium on Process Data Logging, Stratford Hotel, Philadelphia.

8-9 American Association of Petroleum Geologists, Society of Exploration Geophysicists, and Society of Economic Paleontologists and Mineralogists, Pacific Coast Joint Regional Meeting, Ambassador Hotel, Los Angeles.

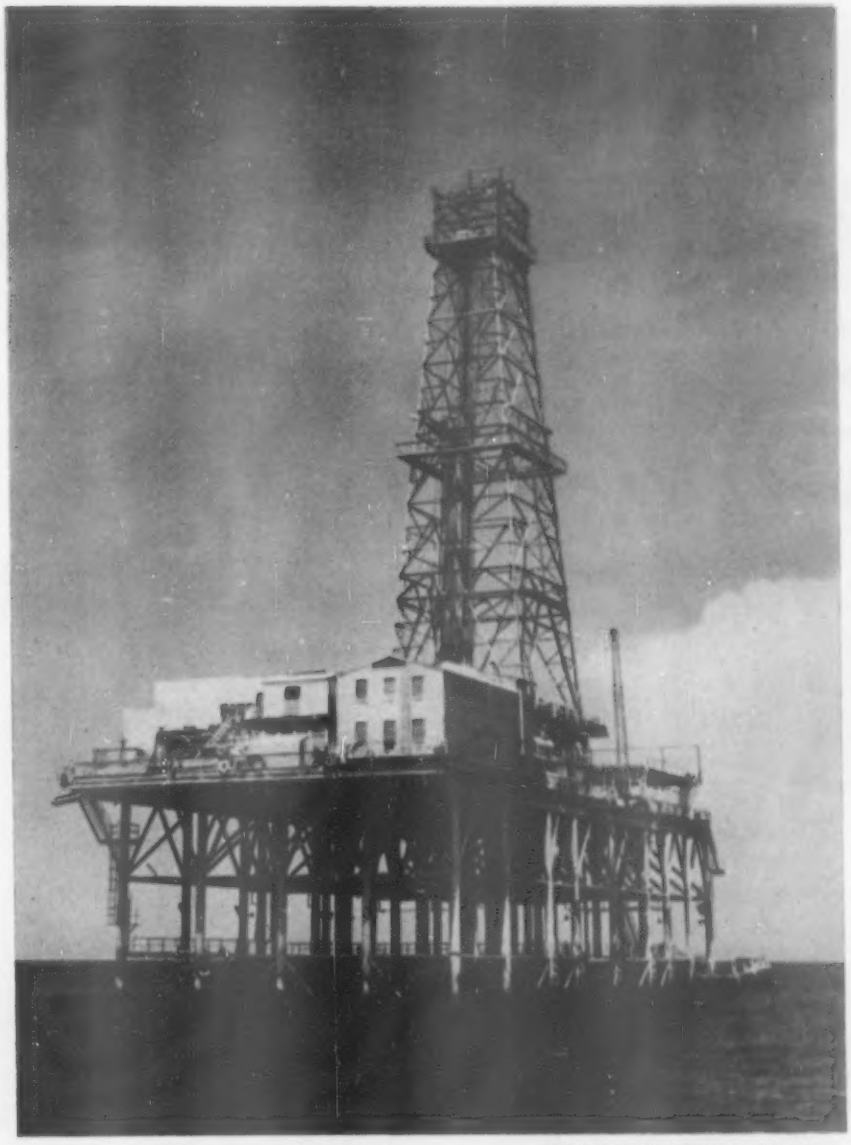
12-15 American Petroleum Institute, annual convention, Conrad Hilton Hotel, Chicago.

19-20 American Institute of Mining, Metallurgical & Petroleum Engineers, North Texas Secondary Recovery Symposium, Municipal Auditorium, Wichita Falls.

25-30 American Society of Mechanical Engineers, Statler Hotel, New York.

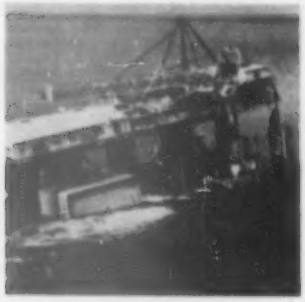
JANUARY (1957)

14-16 Pipe Line Contractors Association, ninth annual convention, Boca Raton Hotel and Club, Boca Raton, Fla.



OFFSHORE SOUTH LOUISIANA—Six wells are directionally drilled from this structure specially designed by Lee C. Moore Corporation.

General view of offshore drilling platform. Visible are drilling derrick, crew housing facilities, mud tanks and other equipment.



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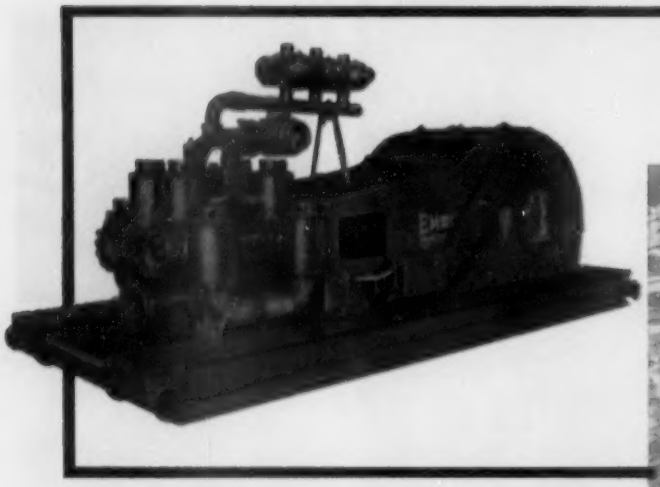

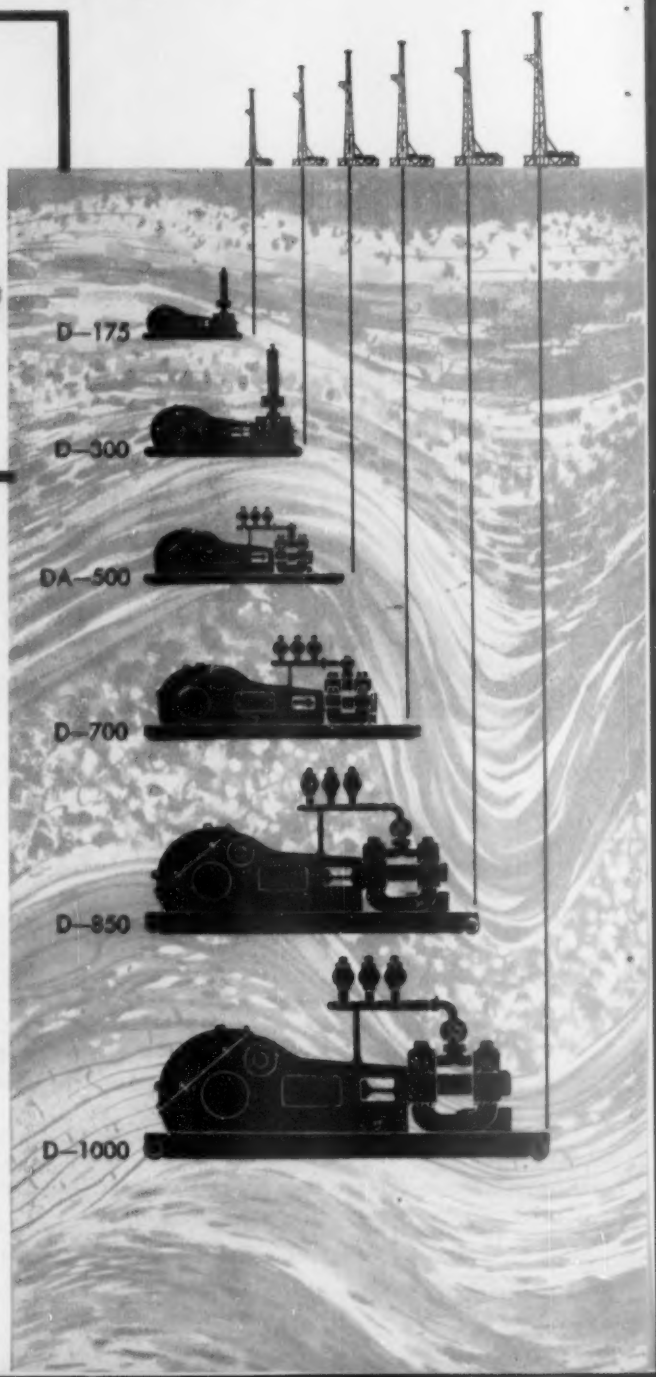

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JOURNALLY SPEAKING . . .

Anchors Aweigh!

IT'S always gratifying to see a zealous public servant, one so ardently devoted to his assignment that he gets evangelical about it even at a social gathering. We taxpayers sometimes suspect that some of our government officials don't always work as hard as they might, so when we run across one who works overtime it's indeed a pleasure.

Such, for instance, as the rotund, genial Navy captain we met at a recent dinner party. All went pleasantly until he discovered our occupational connection, and then he began to bristle. It seems he wasn't pleased by an editorial in the Big Yellow Book (May 14, page 93) which took a dim view of the whole idea of naval petroleum reserves.

Obviously we were living in abysmal ignorance about the Government, the oil industry, and national defense, and here was an opportunity for him to give us some much-needed enlightenment. This he proceeded to do, with all the aplomb of an old-school-tie Annapolis man indoctrinating a plebe.

In the first place, said the Captain, the Navy is a branch of the United States Government and operates as directed by Congress. So when an editorial writer criticizes the Navy he is criticizing Congress, and since Congress represents all of us he is indicting the whole American people and this causes people to lose faith in the Government and undermines the foundations of democracy.

We gulped, but stopped our mouth with a handful of the hostess' salted peanuts.

In the second place, the Captain continued, his geniality lessening by the minute, Congress has by law directed the Navy to build up petroleum reserves and hold them intact for a national emergency, and that's been the firm national policy for more than 40 years.

We attempted to demur that we had been given to understand, by people in a position to know, that most of the "law" on which the Navy relies consists of a suggestion by a congressional subcommittee plus the Navy's own and highly debatable construction of some obscure language in an unrelated statute.

But the Captain, by this time red-faced and vibrant, was, in the tradition of the illustrious Farragut, going full steam ahead and damn the torpedoes.

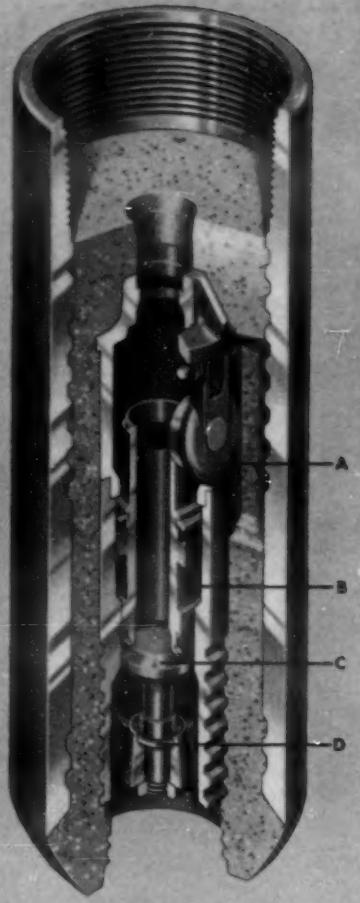
His Gatling gun was going at a great clip, but through the rockets' red glare we gathered the inference that any criticism of the Navy's petroleum reserves program was tantamount to a subversive attempt to undermine the nation's defenses by destroying its oil resources; and that the real reason for the criticism undoubtedly was the greedy oil industry's desire to get its hands on the Navy's invaluable oil reserves and wastefully deplete them to its own great profit and in defiance of the public weal; and that if such criticism didn't stop, the oil industry would be blasted by a congressional investigation that would make the Teapot Dome scandal look like a Sunday School picnic; and that at this time when the oil industry was trying so hard to make friends with Congress and the public it ill behooved it—and particularly an upstart like us who brashly presumed to speak for it—to voice any criticism of Congress and public policy.

The barrage was interrupted by the hostess, who intervened with some inane pleasantries, and the Navy gracefully withdrew from the scene of battle before we could unlimber our guns for a single return shot.

We've heard it said that there are three ways of doing things: the right way, the wrong way, and the Navy way. But insofar as concerns the way to be assured of ample oil supplies in case of war, the Captain wasn't able to show us much difference between ways No. 2 and No. 3.

As we said, it's gratifying to find a public servant so zealous in carrying out what he believes to be public policy. But we will risk undermining the foundations of our republic by venturing the suggestion that if public policy for getting oil for national defense is really what that Captain thinks it is, Congress might well take another look at the policy.

Henry D. Ralph.



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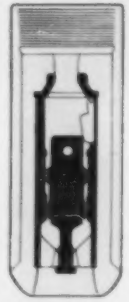
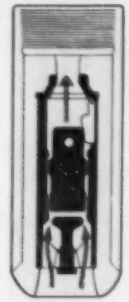
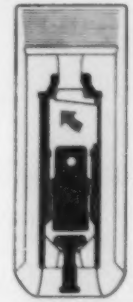
HOW DIFFERENTIAL EQUIPMENT WORKS



RUNNING-IN
Sleeve Valve in closed position



RUNNING-IN
Sleeve Valve in opened position



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Defense is the basic issue in oil imports

THE doctrine that the oil industry (among others) is so important to national defense that it needs special protection against imports competition is coming under serious question. A congressional committee is scheduled to give it a working over this summer.

Typical of the growing murmur of protest is a widely noted editorial in a recent issue of Barron's Weekly. This said that the argument that national defense will suffer if oil imports exceed a certain formula "has never seemed particularly convincing" in view of the apparent activity and prosperity of the domestic industry.

THE OPPOSITE VIEW was stated in a policy speech to the Interstate Oil Compact Commission by Under Secretary of State Herbert Hoover, Jr.

It is established national policy, Hoover said, to maintain a proper balance between imports and domestic oil production so that our energy industries will be in the best possible shape for any future emergency. This means an import policy that will encourage the maximum practical effort toward oil exploration here at home.

True, said Hoover, domestic oil production, drilling activity, and proved reserves are at all-time highs. But he pointed out that costs of discovery and development in the United States are rising, increases in reserves per well drilled are falling, and flush, low-cost oil from some areas of the world can be laid down here more cheaply than it can be found and produced domestically.

Both Hoover and Barron's agree that a quota system would spawn a brood of problems and frictions at home and abroad, such as country discrimination, freezing out new importers, and regimentation of the industry.

But neither one added much enlightenment to the basic issue of when and how much protection is needed to keep the industry fit for defense. Barron's said the case isn't convincing, and dismissed it. Hoover assumed that stating the case constitutes proof. Congress, and other students, will want something more concrete and specific.

THE JOB FOR PRODUCERS, during the coming months of increasing debate over oil imports, is to pin point their case against imports and to keep it based squarely on defense considerations.

A formula for measuring the defense-supporting capacity of the domestic industry must be devised which is more definitive and inclusive than a few random factors such as drilling activity or the earnings reports of selected companies. And means must be found for determining more clearly just how imports affect this condition.

The only case for imports limitation acceptable to Congress or the public is defense. And the only chance of domestic producers to win that case is to state it more convincingly than in the past.

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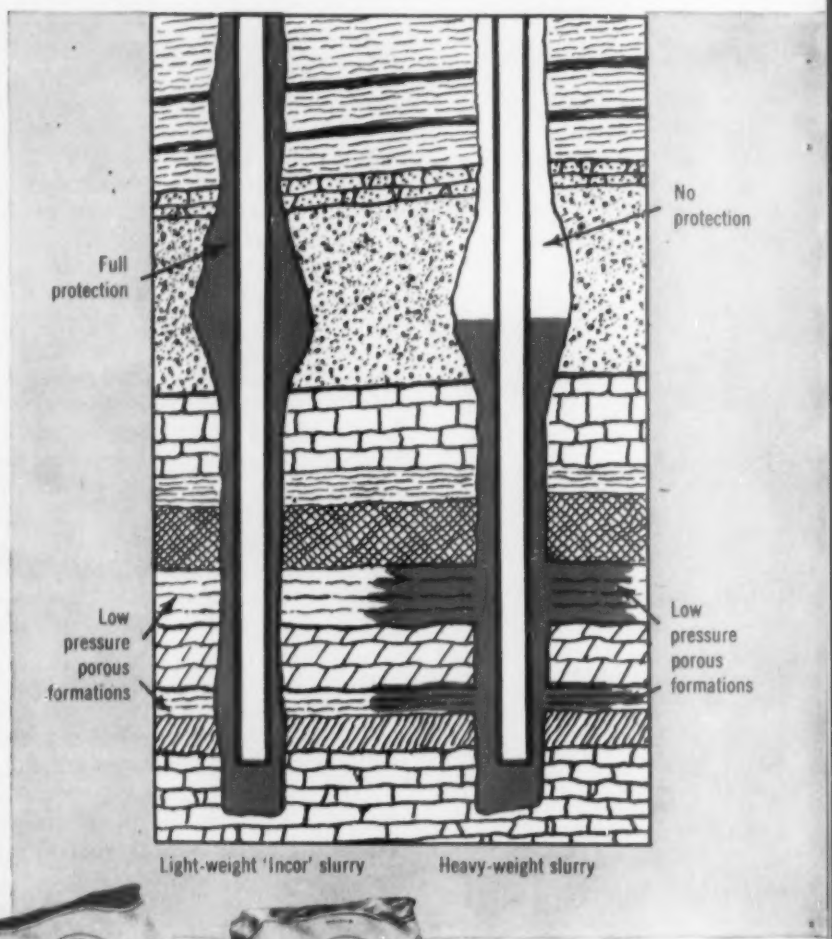

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Current and significant in . . .

The Industry This Week

Offshore

• **Confusion following Supreme Court freeze** on new drilling and leasing in the Louisiana tidelands is causing operators to fear a possible 8-month slowdown in development work offshore. Big hope is that Louisiana and federal Government may get together and figure out way to keep operations going while court is deciding the boundary dispute. P. 136.

Union Oil's wild gas well off the Louisiana coast is believed the worst in tidelands history. The crew has abandoned the toppling well and the company is looking for equipment to kill the well. P. 144.

Exploration

• **There's plenty of method in British-American's** wildcat madness. B.A.'s five significant wildcat strikes so far this year ranks it at the top of the nation's oil explorers. P. 130.

Biggest discovery inside Hugoton field has been made by Panhandle Eastern Pipeline Co. Its 2-24 Ballew east of Guymon flowed 1,000 bbl. of oil and 80,000 M.c.f. gas daily. P. 141.

An oil-industry newcomer—Consolidated American Industries, Inc.—has won a 2,240,000-acre concession in Panama. Two wildcats are planned by next June. P. 148.

Drilling

• **Turbodrills may be making hole** in the U. S. before the year is out. Dresser Industries has signed a deal with a French firm to make the turbodrill. The firm dropped its Russian deal when federal officials objected. P. 134.

Processing

• **More 100-octane marketers** are expected to join Jersey Standard and Sun this summer. That's the word at the Penn Grade meeting last week. Oil men heard test results on new U.O.P. isomerization process to convert pentanes and hexanes into high-octane components. P. 138.

A second firm—M. W. Kellogg Co.—has acquired a potential site in Phillips' new multimillion-dollar petrochemical center along the Houston ship channel. Kellogg is expected to build a polyethylene plant there. P. 144.

Indiana Standard has licensed Eastman Kodak to use its low-pressure polyethylene process in manufacturing plastics. Eastman plans to build a semicommercial plant at Longview, Tex., immediately. P. 145.

Dow Chemical is moving to buy Bay Refining, Saginaw, Mich. Dow may build a major petrochemical plant nearby. P. 142.

Industry

• **Grace-Cosden merger is off.** Cosden's oil reserves did not reach the minimum specified in the original agreement and Cosden directors refused to reduce asking price for the company. Grace then bought into Texas Gulf Producing and its huge Libyan concession. P. 133.

Resentment at administration's oil-imports policy is rising among congressmen from oil-producing states. Two blistered ODM Chief Flemming on House floor last week just after Flemming had ordered another study of the problem. P. 133.

Giant Texaco apparently will get even bigger. Prime Minister Anthony Eden's government last week approved purchase by Texaco of Trinidad Oil Co., Ltd. In addition to properties on the island of Trinidad, the $176-million deal will give Texas Co. properties in England and Canada. P. 149.

Wildcatting Success Secret: Play It Big

● There's method-in-madness behind British-American's five significant wildcat discoveries so far this year

In Texas . . .

British-American finds thick Woodbine section, good show in Eagle Ford in overhang of Hainesville salt dome.

In Oklahoma . . .

Its 2 Harrison in Grady County is state's deepest flowing well with prolific gas production and considerable condensate.

In New Mexico . . .

The 1 Marye may have opened up a "junior-type Pembina" indicating a Gallup sand strat trap covers 40,000 acres.

Robert J. Enright

DALLAS.—Early this month British-American Oil Producing Co., drilling through the overhang of Hainesville salt dome in Wood County, East Texas, struck what may be a major Woodbine discovery.

The company's 1 Weisenhunt, about 7 miles northeast of Mineola and between Van and Hawkins fields in the deepest part of the East Texas basin, cored about 85 ft. of net effective Woodbine pay. Oil saturation of cores is estimated by Core Laboratories at 15 to 18 per cent.

Testing and more drilling is needed to evaluate the find. But right now it looks good.

Top wildcatter . . . In any case, the 1 Weisenhunt will further cement British-American's standing as probably the country's top rank wildcatter of the year so far.

It would be the company's fifth "wild" wildcat success this year to be regarded by the industry generally as highly significant.

There have been other good B. A. discoveries, too, some of them in the rank class, but these five are standouts.

The spectacular B. A. run began with its fabulous 2 Harrison, completed February 14 in the third Bromide sand in Oklahoma's Grady County as the deepest producing well ever completed in Oklahoma. This one, with only 60 ft. of a Bromide section of almost 300 ft. open to production, already has produced nearly 600,000,000 cu. ft. of gas and substantial volumes of condensate.

Three days later on February 17, the 1 Montana in Carbon County, Montana, was completed as an excellent oiler in about 50 ft. of net effective Lakota pay. Initial production of about 250 bbl. a day through small-size choke is holding up well, and a confirmation test is now drilling.

March 17, B. A. hit with its 1 Marye in San Juan County, New Mexico. Some in the industry are terming the strike "a junior-type Pembina"—only it doesn't look so small. Confirmation tests by B. A. and others make it appear that this Black Rock or Bisti Gallup pool is a strat trap which will produce over an area 4 to 7 miles wide and at least 10 miles long and probably more. Drilling already indicates a producing area of at least 40,000 acres. B. A. has a block in the area of roughly 13,000 acres.

On March 30, the company made headline oil news again with the discovery in its 1 Noelke of Sixty-Seven field in Irion County, Texas. This was the first Strawn reef production in this part of West Texas, and it created a big stir.

The salt-dome strike in the East Texas basin, followed a few days later by a similar discovery by The Texas Co. on the Bethel dome in Anderson County, has done the same thing for the East Texas basin.

Such a rapid-fire string of rank-wildcat bull's-eyes led the Journal to inquire into the why's and how's.

How B. A. does it . . . British-American Oil Producing, though having a net worth today of roughly $56,000,000 excluding reserves (from a $100,000 investment 30 years ago), is classed as a medium-sized oil company.

It is a subsidiary of the Canadian firm, British American Oil Co., Ltd. Other than having its annual budget approved by the parent firm, however, it operates entirely independently and spends its money as it sees fit.

Directing operations at the Dallas headquarters is Robert E. Kepke, executive vice president. And heading up the exploration department is J. E. Matter, vice president-exploration.

Matter attributes B.A.'s remarkable wildcatting record this year to "a lot of luck and a little willingness on our part to attempt things somewhat risky or unorthodox."

B.A.'s formula for exploration success, however, goes deeper than this. Its philosophy calls for:

. . . Thinking big. It looks first at exploration regionally rather than locally. It operates only in areas where discoveries are likely to be large. Then it concentrates on the pay zones in that region which normally are prolific—such as Ellenburger and Devonian in West Texas and the Miocene in South Louisiana, and Simpson in Oklahoma.

. . . Taking the big risk where what

it may find is likely to be big. B.A. has often drilled where other (and larger) firms had looked and turned away. The big Bromide discovery in Oklahoma is one example.

This deep test, in complex and tough drilling terrain, cost the company roughly $700,000. B.A. figures it almost halved the drilling cost, though, by painstaking engineering work before the test was spudded.

"If we'd been unlucky," Kepke points out, "the 2 Harrison could have cost us more than twice as much and likely would have used up our whole exploration budget for Oklahoma."

...Standing aloof from the general run of lease plays B.A. doesn't "spread itself too thin" by rushing in to lease whenever another company makes a discovery. Its exploration budget isn't large, comparatively. And the company prefers to pick its spots and buy leases more selectively.

...Delegating search authority. B.A.'s exploration department is highly decentralized—more so, according to Matter, "than that of any other company I know."

The company's four division exploration managers are given lots of leeway. "The Dallas headquarters coordinates the effort and supervises the budget," Matter says. "We believe we can move faster this way, and with less red tape."

...Hiring more and better hands. B.A.'s exploration department has grown strikingly in the last 5 years since Matter became manager. It has doubled its number of office locations and tripled its personnel. Geological, geophysical, and land branches have all expanded roughly in proportion.

In the fall of 1951 (when B.A. was still headquartered in Tulsa), the company had exploration offices in Tulsa, Fort Worth, Casper, Oklahoma City, Houston, Shreveport, and Sidney, Neb. Seven in all.

It now has 13. Division offices are in Oklahoma City, Midland, Denver, and Houston. District offices at Ardmore, Amarillo, Fort Worth, Casper, Billings, New Orleans, and Tyler. Subdistricts at Fort Morgan, Colo., and Farmington, N. M.

The key members of the exploration staff are young, averaging about 39 to 40 years.

Division managers don't hesitate to use their initiative or to recommend risky drilling ventures. The 2 Harrison in Oklahoma serves as a good example here, too.

Division manager at Oklahoma City is John Melton. Kepke says Melton pushed hard for the deep Grady County test for several years. The venture was so obviously risky and expensive, though, that the decision to drill didn't come immediately. As Kepke puts it, "We had a good discovery year in 1954 and found quite a bit of oil, so we finally said let's take a crack at it. Melton gave up other, possibly-more-sure, prospects in order to drill it."

The Men Behind B.A.'s Winning Streak

J. E. MATTER
Exploration Vice President

JACK HOLLIS
Chief Geophysicist

JOHN MELTON
Oklahoma City

F. S. GOERNER
Houston

C. H. ATCHISON
Midland

W. O. CALLAWAY
Denver

Division Exploration Managers

Any exploration method . . . B.A. makes liberal use of just about all known exploration methods except the divining rod to find oil.

It appears, perhaps, to get more mileage out of its geophysical work than many companies. Its apparent Woodbine sand find near Mineola in East Texas resulted from shooting and reshooting which defined the spine and overhang of the Hainesville salt dome. The 1 Weisenhunt entered and emerged from the salt very near where B.A.'s geophysical folk said it should.

The company definitely doesn't rely alone on geophysics though. Of the five significant strikes this year, the 1 Weisenhunt was the only one due wholly to this type of exploration.

The North Clark Fork discovery in Montana, which appears to be a faulted nose of anticline type of pool, was due primarily to surface geology and some seismograph work.

The 1 Marye in San Juan County, New Mexico, was drilled on the basis of surface and subsurface geology (three strat tests) and on the strength of the El Paso Natural Gas Co. strike 4 miles to the southeast.

The Strawn reef strike in Irion County, West Texas, was a "classic example of coordinated geology and geophysics . . . and luck," according to Matter. "We had a high and a little suggestion of thinning. God had his arm around us there."

Shooting played little part in the Oklahoma deep test. The pool is of the faulted-anticline type. Existence and location of the nearby big fault and the possibilities of deep zones in the area were well known.

Sometimes none at all . . . B.A. sometimes, as a matter of fact, drills with no definite geologic reason. It does this, however, only in suitable areas and the only suitable area to date has been the Denver-Julesburg basin.

This is fast, easy drilling and pays are mostly shallow — about 5,000 ft.

IN MONTANA a British-American party inspects rough terrain during a survey which located a confirmation test to the North Clark Fork discovery in Carbon County. The second well is now drilling. It should reveal whether oil found by the discovery is an accumulation due to faulting or a pinchout.

Geology is complex, and geophysics not too reliable.

British-American began experimenting early with slim-hole exploratory drilling in this area. It found that it could "walk away from a dry hole in the basin for about $15,000." And as Kepke puts it, "you can't get much geophysics for that, can you?"

The company has made several strikes in the basin by simply going in and leasing acreage, preferably close to production. Then, without any exploration at all, it proceeds to punch down slim holes one per square mile. The company has found it can do this as cheaply as it can shoot such acreage, then drill.

By drilling a well each square mile, the company figures it won't miss anything of any size. And when the acreage has been explored, it has been explored thoroughly.

B.A. leases somewhat differently than most others. General practice for an oil-finding firm is to get geophysical permits from landowners, do its shooting, then return to the landowner to talk leasing if it should find prospects favorable. B.A. prefers either to assemble its lease block first or to secure an option to lease with the geophysical permit.

British-American's many recent strikes indicate it has found a winning combination. The number of discoveries likewise tends to disprove any "fluke" theory — and to prove once more that there's still plenty of room in the oil-finding business for the operator who will take a big calculated risk.

South Louisiana elusive . . . So far this year, British-American has scored major wildcat successes in every one of its major operating areas except South Louisiana.

That large producing region has been somewhat of a jinx in previous years, too. The discoveries just haven't come.

It's unlikely though, that this state of affairs will continue very long. The company's recent exploratory record is too good.

B.A. officials are hopeful that the break may come soon—possibly in a deep sand shot off Cameron Parish in the Gulf of Mexico. The company is drilling this wildcat, its first offshore venture in many years, in partnership with Seaboard Oil Co. and Odeco. The well, the Louisiana G-2, is located about 1½ miles south of the old Creole field.

Fifteen-Mikton Merger Set

HOUSTON.—Fifteen Oil Co. will acquire the assets of Mikton Oil Co. for $1,472,500 in Fifteen stock under a deal approved by the purchasing company's stockholders last week.

The transaction, effective July 1, is subject to approval by Mikton stockholders at a special meeting June 18.

Mikton has approximately 5,000 acres of productive leases, located mostly in southern Louisiana, in addition to producing properties on Boling Dome in Wharton County, Texas, and other holdings in Mobile County, Alabama. The company's gross oil production totals about 1,100 bbl. daily.

Industry BRIEFS

HOUSTON.—A new oil field has been opened on the Gulf Coast at the edge of Galveston Bay by Continental Oil Co. The wildcat opening the production is the 1 State Tract 2-3A, off Fisher's Reef in the Trinity Bay area of Chambers County. It is 2 miles west of Eagle, Tex., and 1½ miles west of nearest production.

On a drill-stem test of the Frio formation at 9,197-9,204 ft., the well flowed 37.8°-gravity oil at the rate of 206 bbl. daily.

NEWPORT NEWS.—The American Oil Co. has signed a multimillion dollar contract with Newport News Shipbuilding & Dry Dock Co. for converting three of Amoco's T-2 type tankers to increase carrying capacity of each ship by 25 per cent.

WASHINGTON.—Gulf Interstate Gas Co., Houston, has been authorized by the Federal Power Commission to increase the compressor horsepower of its line at a cost of $2,070,000. Additional 2,000-hp. compressor units will be installed at four stations along the line from Louisiana to Kentucky.

SAN ANTONIO. — Stockholders of Producers Corp. of Nevada have voted to change the company's name to Texam Oil Corp. and increase capitalization by one million shares. Texam's oil exploration and production activities center in Texas and Oklahoma.

WASHINGTON.—The Supreme Court recessed last week without taking action on an important pipeline case. It did not announce whether it would review the District of Columbia appeals court decision requiring the FPC to consider cost in arriving at the fair field price to be allowed for gas produced by pipeline companies. Panhandle Eastern Pipe Line Co. had filed an appeal from that decision last month and the FPC also later appealed.

TULSA.—D. D. Feldman Oil & Gas has acquired the interests of Villard Martin et al., Tulsa, and Progress Petroleum, Inc., Houston, in Fitts field, Pontotoc County, Oklahoma. Properties include 90 wells on 1,700 acres producing 470 bbl. of oil daily. It has been reported Feldman is considering a water flood in the area.

MIDLAND.—Permian Oil Co., Midland, has acquired Cities Service Oil Co.'s Chico crude-oil-gathering system in Wise County, North Texas. The system handles about 500 bbl. daily.

Import Anger Boiling

Congressmen accuse Flemming of "surrender" to importing oil companies; ODM Chief ordering another basic study

WASHINGTON.—Congressional resentment over Mobilization Director Arthur S. Flemming's latest plan to control oil imports burst on the House floor last week.

The administration has "surrendered" to the oil importing companies, it was charged by Reps. Frank Ikard of Texas and John Jarman of Oklahoma.

And unless Flemming takes "positive action" over the next few months Congress will be asked again next year to lay down mandatory quotas, they warned.

Flemming criticized . . . The attack was directly aimed at Flemming.

He is required to recommend an investigation when levels of oil imports become excessive, under Section 7 of the Trade Agreements Act. And domestic producers have long contended such an investigation is overdue.

The outburst in the House came only a few hours after Flemming announced that the four-man task force, which in 1954 made the basic studies on which the cabinet fuels committee last year recommended a proper level for imports, had agreed to make another study.

Flemming said last month that a "re-examination" would be made before September 1. If it shows that import programs then are dangerous to the national security, a hearing will be called within 30 days, he promised *(The Oil and Gas Journal, May 21, page 140)*.

Carrying the producers' complaints to the House floor, Ikard and Jarman charged that the new formula written by Flemming last month is a "complete surrender" to the importing companies. More than 75 per cent of the total imports are to be ignored, they said. The result will be more rather than less oil coming into the U. S.

Story of failure . . . The congressmen spelled out in detail the effects of the administration's failure to bring about import control:

. . . More than 2,000,000 bbl. daily of oil is now shut in the ground as a result of increasing imports.

. . . Producers will lose income this year of more than $310,000,000 from the 301,000 bbl. daily by which imports are topping the cabinet committee recommendation.

The experience has been that seven wells are completed for every million dollars of income from oil and gas. The $310,000,000 loss this year, therefore, means that 2,170 wells will not be drilled. More than 1,000 of those wells would be expected to be oil producers and nearly 175 gas producers.

"It is clear that if imports are left unrestrained in the next 10 years, as they have been in the past 10 years, income to domestic producers to plow back in the ground to prove and develop new oil reserves can be severely curtailed so as to mean the difference between victory and defeat in any future war," Ikard declared.

Domestic producers can't stand much more "voluntary control," Jarman warned. The repeated and increasing cutbacks in allowables in recent months shows the necessity for Congress to act, he said.

The importing companies are "powerfully persuasive," Jarman told the House. They apparently convinced the ODM that they really intend to employ voluntary restraint, he said. But the new study will give them the most part of a year to increase imports at the expense of the domestic industry.

"I for one do not propose to stand tongue-tied while these companies lullaby the ODM into actions which violate every intent of Congress, every accepted statement of industrial policy and, even worse, the assurances given by the administration that oil-import reductions would be effectuated," Jarman asserted.

The new study . . . All members of the original task force have accepted the assignment to make the new study, Flemming said.

J. Ed Warren, former president of the Independent Petroleum Association of America and head of the Petroleum Administration for Defense and now a vice president of National City Bank of New York, will represent the oil and gas industry.

James F. Brownell of J. H. Whitney & Co., New York, is chairman of the group. Other members are Charles J. Potter, president of the Rochester & Pittsburgh Coal Co., for coal, and retired Federal Judge Robert N. Wilkin for the public.

No date has been set for the first meeting of the task force. But ODM officials said it would be held soon. The review is expected to take 6 to 8 weeks.

Grace-Cosden Merger Is Off

Grace gets into oil business through another deal which gives the company 49 per cent of huge Libyan concession

NEW YORK.—W. R. Grace & Co.'s merger with Cosden Petroleum Corp., Big Spring, Tex., fell through last week.

But Grace moved to complete another deal which puts the international banking, chemical, mercantile, and steamship company into the oil business.

Grace will purchase a small minority interest in Texas Gulf Producing Co., Houston, in a package transaction giving it a 49 per cent interest in a Libyan concession held by Texas Gulf Producing.

Why merger failed . . . The merger was called off in an announcement by J. Peter Grace, president of W. R. Grace, and Raymond L. Tollett, president of Cosden. Grace would have paid the equivalent of $55,000,000 for the integrated company *(The Oil and Gas Journal, April 30, page 83)*.

Proven crude reserves of Cosden, as estimated by DeGolyer & MacNaughton, Dallas consultants, didn't come up to the minimum 17,765,000 bbl. required in the agreement. Grace wanted to lower the price it was offering. But the Cosden management, after polling its board of directors, would not consider anything less.

New oil move . . . Grace will buy 50,000 shares of Texas Gulf Producing stock at the May 11 market price of $44.50 per share for a total cost of $2,225,000. The deal will give Grace a 1½ per cent interest in the company.

Grace also is putting up $7,500,000 for a 49 per cent interest in a license covering 25,000,000 acres in six sections of Libya held by Libyan American Oil Co., a Texas Gulf subsidiary *(The Oil and Gas Journal, May 28, page 105)*.

The Houston independent specified last week that the deal gives Grace an interest in the concession itself, not in Libyan American, which will remain a wholly owned subsidiary of Texas Gulf. Libyan American will receive 51 per cent of net revenue from the operations after certain exploration obligations are met.

Turbodrill Deal Signed

Dresser to turn out hydraulic-drilling tool with French instead of Russian design; first ones may be ready soon

DALLAS.—The United States drilling industry may be making hole with its first turbodrill before the year is up.

The drill will be manufactured in the United States by Dresser Industries, Inc. The new tool will be of French design rather than Russian, however.

Dresser will manufacture the French-style hydraulic turbine under license from Établissements Neyrpic, Paris, and sell it in this country, Canada, Venezuela, and Mexico.

Neyrpic, in return, will receive an undisclosed royalty payment for each drill Dresser sells. It also will be granted the use of Dresser's world-wide field organization to distribute and service its French-made equipment.

The French drill so far is not being turned out in large quantities. Performance of the several prototypes now being used in southern France is reported to be impressive. No details are available on the French version. It is said, however, to approach the efficiency of the Russian drill which the Soviets claim will make hole 10 times faster than the modern rotary.

The agreement with Neyrpic was negotiated in Paris by Dresser's energetic executive vice president, J. B. O'Connor. Last March in Moscow O'Connor talked the Russians into agreeing to sell Dresser 40 of their turbodrills and into permitting the United States firm to manufacture the drills in this country. The Commerce Department turned thumbs down on that deal because Dresser, as its part of the bargain, would have had to give the Russians technical data on the manufacture of U. S. rock bits.

Dresser has declined so far to compare merits of the French and Russian products. But indications are the Russian drill is more advanced.

Other Dresser moves . . . The Neyrpic deal for the French turbodrill was one of several that O'Connor firmed up during his short stay in France.

In the others, he:

. . . Signed agreement permitting Établissements du Jardin, compressor manufacturer of Lille, France, to make and sell reciprocating compressor units made in this country by Clark Brothers Co., one of the Dresser industries. The French firm has rights to make all types of Clark compressors (gas, steam, electric, and diesel) ranging from 100 to over 4,000 hp.

. . . Announced a new company, Societe Francaise des Industries Dresser, S. A., which will represent several of the Dresser companies on the continent. President of the new firm is Raymond Chesneaux, Paris.

. . . Extended license of another French company, Batignolles-Chatillon Co., to handle the full range of pumps made by another Dresser firm, Pacific Pumps, Inc.

Turbodrill plans . . . O'Connor said Dresser is "greatly pleased" with the Neyrpic turbodrill deal and is sending field drilling engineers to France to work with the French firm on hydraulic-drilling problems.

He lauded Neyrpic hydraulic-drilling research and development laboratory at Grenoble, France, as one of the finest in the world.

Florida Field Abandoned

MIAMI.—One of Florida's two oil fields has been abandoned. The two wells which made up 40 Mile Bend field, 40 miles west of here, were plugged after they went to salt water.

They had produced a total of 32,848 bbl. of 20°-gravity oil. One had been completed by Gulf Oil Corp. and the other by Commonwealth Oil Co. The wells were 3 miles apart.

Florida's initial producing area, Sunniland field in Collier County, continues on production. Operated by Humble Oil & Refining Co., it had produced 4,482,749 bbl. up to May 1, 1955.

Rubber Output Sets Record

NEW YORK.—Synthetic rubber production in the U. S. hit an all-time high last year of 2.26 billion pounds. This was an increase over 1954 of nearly 60 per cent for all types and close to 75 per cent for the major GR-S type.

The boost reflects the sale of government facilities early last year to private industry and the vast investment which is going into new and improved capacity.

The former record of just over 2 billion pounds was set in 1951. This barely topped the previous peak year of 1945, when all-out production occurred during the close of the war.

Since 1951, output had shown a gradual decline until the industry got a shot in the arm last year. New records set during the first 3 months of this year indicate another record production is in the making, although some major consumption factors are expected to show declines.

Oil Men Recruited

U. S. to train executive reserve for emergencies

WASHINGTON. — A training program to prepare oil and gas executives for service in key government posts in the event of another war will be undertaken this fall by the Interior Department's office of oil and gas.

A provision in the new Defense Production Act permits certain federal agencies to set up what will be known as an "executive reserve." It will consist of industry men who will be trained for jobs in the next war's version of the Petroleum Administration for Defense and other emergency agencies. But they will be called for active service only in the event of an emergency.

The executive reserve was set up as a partial answer to the situation resulting from restrictions imposed by Congress on the employment of industry men without pay (WOC's) by the Interior, Defense and Commerce departments.

The plan calls for the recruiting in peacetime of men who would take over posts where their industry experience would be needed in an emergency. When appointed, these men will be brought to Washington and briefed on the Government's way of doing business and the jobs in which they would serve. They would be asked to return at least once a year for additional training and briefing on current developments.

Men will be appointed to the executive reserve only if their employers agree they can take the training and accept government employment in an emergency. Appointees also will have to file a full report of their financial interests, as WOC's now do.

Remote Station Practical

WASHINGTON.—The robot natural-gas compressor station has proved workable.

That was the word passed on last week by the Federal Power Commission. It was implicit in an order allowing Gulf Interstate Gas Co. to make its experimental satellite station near Stanton, Ky., a permanent part of its

facilities. Four more remote stations are reported to be in the works on the Gulf Interstate system.

The Stanton station is a 3,500-hp., 4-cycle, turbo-charged vertical gas engine driving a centrifugal compressor through a speed increaser. Operations are controlled over direct wire from another station at Clementsville, Ky., 80 miles away. Essential operating information is telemetered back to the controlling station.

Gulf Interstate's robot station is the only one of its kind. It was built under a certificate issued by the FPC in April 1955 as an experiment. The company was given 15 months to test it out but within a year reported satellite operation was both feasible and economic. Estimated cost of the station was $730,000.

Asphalt Losing Out

Military air fields will get all-concrete runways

WASHINGTON.—The Air Force over the next few years will abandon the use of asphalt on runways, a House appropriations subcommittee disclosed last week.

The Navy also is switching to concrete, it was brought out in recent hearings before the subcommittee.

The Air Force runway building program for the coming fiscal year will cost approximately $325,000,000. For the past 4 or 5 years asphalt and concrete have been used on a near 50-50 basis. But heavier planes and the jet engine have shown that asphalt does not stand up as well as concrete, Air Force officials told the subcommittee.

While, in a few instances, contracts for concrete runways have been secured at about the same price as asphalt, portland cement has been bid up to 60 per cent higher than asphalt, it was admitted by Gen. Lee B. Washbourne, assistant chief of staff for installations. In general, however, he said, the big bids showed that the 5 per cent premium allowed for concrete covered more than half the difference.

The decision to go to all-concrete construction followed investigations made over a 17-month period. The study showed that asphalt failed to stand up under the traffic of heavy B-47 and B-52 aircraft. Last December, Defense Secretary Wilson approved the use exclusively of concrete for all primary airfield pavement.

Runways represent 16 per cent of the capital cost of bases, General Washbourne said. The Air Force has enough pavement to provide a 9-ft. taxiway from Washington to Moscow, he told the subcommittee.

watching WASHINGTON

. . . with Bertram F. Linz

Wanted: Refuges for royalties for refuges . . .

REP. JOHN J. DINGELL has a scheme for increasing the number of wildlife refuges. He would use the Government revenue from oil and gas leases on the refuges to buy more of them. Then the new ones could be developed, and still more bought, and so on.

Dingell hasn't figured how much money is coming in from the 82 oil leases he says have been granted on 19 sanctuaries. But, added to the $4,600,000 a year derived from the sale of duck stamps to hunters, it would give the Government a substantial sum. The only trouble, Dingell said ruefully, is that it costs so much to maintain the refuges that it's hard to lay by money to purchase more land.

The Interior Department wants to add another million acres to the refuge total. Dingell plans to help by an amendment to the Mineral Leasing Act of 1920. It would turn all revenue from the refuges over to the department for that purpose.

The Treasury's piggy bank gets only 10 per cent of the more than $60,000,000 a year collected from development of government lands. The states get 37½ per cent of the take for schools and roads, and 52½ per cent goes into the reclamation fund. Only a fraction of the $6,000,000 comes from wildlife reserves.

Arkansas water-flood project sought . . .

THE Interior Department wants some operator to start an experimental water-flooding project in the Buckrange reservoir of Stephens field in Arkansas.

Output of the area dropped from a peak of 875,000 bbl. in 1924 to 182,000 bbl. in 1954 and is still declining, a department study showed. Less than 10,000,000 bbl. of oil have been taken out of the field which was estimated at 126,000,000 bbl. when it was discovered in 1922.

A suitable fluid injection would add 26 years to the area's life and produce almost twice as much oil as can be recovered profitably by present methods, the department believes.

But whether the Buckrange reservoir is suitable for water flooding can be shown only by an actual field secondary-recovery operation.

Building spree hits world tanker fleet . . .

TANKER building is booming throughout the world.

More than half the merchant-vessel tonnage on order at the start of this year will be devoted to oil movement, a survey by the American Merchant Marine Institute shows.

More than 12,500,000 deadweight tons of tanker capacity is being built. Only a small part of this construction is going on in this country. But the U. S. contribution should be substantially increased this year with final contracts to construct 14 tankers for long-term charter to the Military Sea Transportation Service. And plans are being made for new types of vessels, such as combination oil and ore carriers, which may add to our total.

The world is in the midst of a shipbuilding spree which may run for years. The Maritime Administration's replacement program already has commitments for the building of 180 cargo carriers over the next 20 years.

The world tanker fleet totaled 39,500,000 deadweight tons at the start of the year. Current building will bring it to 52,000,000 tons. That will be three times the size of the fleet in 1939. In contrast, the dry-cargo fleet will be only 42 per cent larger than prewar.

The passenger fleet may never again reach its 1939 level. Today the passenger tonnage is 32 per cent less than prewar. The current building program will bring it up only to 73 per cent of the prewar figure.

Offshore Drilling Facing Slowdown

- **Some Louisiana operators see 8-month paralysis in new drilling until Supreme Court clears boundary confusion**
- **Justices order "status quo" in drilling and leasing; One bright hope: Louisiana is willing to negotiate**

NEW ORLEANS.—The Supreme Court's failure to determine Louisiana's gulfward boundary is threatening to paralyze multimillion dollar exploration and development drilling in an offshore strip 35 or 40 miles wide.

Reaction among offshore operators to the court action last week varied all over the lot. It ranged from a cautious sigh of relief at a letup in federal-state leasing competition to a dire prediction: "This is going to put people out of business."

In a ruling handed down just before justices took a 3½-month vacation, the court:

. . . **Set aside a state injunction** which had halted the Interior Department's planned sale of leases *(The Oil and Gas Journal, May 21, page 138).*

. . . **Ordered both the Government and Louisiana** to make no new leases until the boundary issue is settled.

. . . **Ordered both parties not to begin drilling** of new wells in the interim. Leasing and drilling, however, may be resumed if state and federal authorities reach a mutual agreement.

The court is expected to settle the boundary dispute at its next term starting in October. It then will decide whether Louisiana is entitled to a boundary of 3 miles or 3 leagues from its coast. Cause of the immediate action before the court, however, was an attempt by the Interior Department to continue leasing tidelands beyond the 3-mile line without waiting for a court decision.

Confusion . . . The ruling on that issue is creating the present confusion.

Puzzled by the vagueness of the court's "status quo" ruling, offshore oil operators generally are reluctant even to speculate on its possible consequences. But they agree on one thing —whatever effect the order has will be a drastic one to oil companies involved.

While waiting for the Supreme Court to reconvene in October, offshore operators generally fear a slow but costly summer. Among the more pessimistic predictions:

. . . **Several companies will be unable** to fulfill drilling obligations on thousands of acres in leases which are due to expire next October 4.

. . . **Drilling will slump** if not cease in practically all producing areas off the coast of Louisiana except in those fields within 3½ miles of shore.

JOHN B. HUSSEY
. . . Has the "big stick"

. . . **Tests may be started** on a few expensive tracts beyond the disputed area, but the seaward migration will be slow since equipment for deep-water drilling is limited.

. . . **Service companies** will have a slack period, with inland competition becoming keener.

. . . **Heavily indebted offshore drilling** contractors will find it hard to keep their heads above water.

. . . **Some big offshore operators** will halt virtually all exploration and development off Louisiana. Others will have millions of dollars tied up in equipment which will sit idle until the antidrilling order is lifted.

One way out . . . Effect of the court ruling need not be this drastic.

The tribunal left one route open for continuation of drilling on present leases. New wells may be started or areas leased only upon mutual agreement by Louisiana and the United States.

Here is how the court spelled it out:

". . . the Attorney General of the State of Louisiana and others named are enjoined from further prosecuting or taking any proceedings in a certain cause now pending in the Fourteenth Judicial District Court in and for the Parish of Calcasieu, State of Louisiana . . . and from prosecuting any other case or cases involving the controversy before this court until further order of the court, and

"It is further ordered that the State of Louisiana and the United States of America are enjoined from leasing or beginning the drilling of new wells in the disputed tidelands area pending further order of this court unless by agreement of the parties filed here."

Louisiana's position . . . There is widespread speculation that Louisiana will be in no hurry to have operations resume in the broad area in which the U. S. is disputing its claim of ownership. State Conservation Commissioner John B. Hussey told the Supreme Court recently that he would not object to shutting down all operations in the disputed zone until the boundary squabble is settled.

Louisiana, with a bothersome surplus of oil on hand, might welcome a letup in production from offshore fields. By agreement with the Department of Interior, Louisiana sets production allowables for fields off its coast, including those in the federal area.

As one company spokesman puts it, Louisiana officials now have the "big stick." By executive order, they apparently can stop practically all tidelands oil operations off the Louisiana coast.

"They can keep you from running over parish roads, they can keep you from jumping off from Louisiana docks. They can really make it rough on you."

The latest layer of confusion surrounding the boundary dispute is an outgrowth of a restaining order issued last month by State District Judge Mark C. Pickerel at Lake Charles. The court order halted the Interior Department's proposed sale of more than 500,000 acres of leases May 15 *(The Oil and Gas Journal, May 21, page 138).*

In last week's order, the Supreme Court knocked out Judge Pickerel's ruling, as requested by the Justice Department. In doing so, the high tribunal imposed its own restrictions on sale of leases and drilling of new wells in the disputed area. Since the court declined to interpret what it meant by "the disputed tidelands area," it may have strengthened Louisiana's case against the federal Government.

At least, that's the way some company officials interpret the legal skir-

mish directed by State Atty. Gen. Jack Gremillion and other leaders in Gov. Earl K. Long's newly inaugurated official family.

"They've accomplished their end," remarked one company spokesman who declined to be quoted by name. "There isn't any doubt about it."

Gremillion interpreted the Supreme Court action in much the same way.

"As I see it," he said, "I think this is a temporary victory for the State of Louisiana." He added he will definitely insist on recognition of Louisiana's "coast line" as defined by the 1954 legislature.

Asked if he foresees any possibility of reaching an agreement under which new wells may be started during the court recess, Gremillion replied: "We would be willing to negotiate on that matter. I imagine that we could get together."

But when asked if the Interior Department had made any move to negotiate, Gremillion said, "I haven't heard from them at all."

Three big questions . . . The Supreme Court left three major questions unanswered in the minds of oil-company attorneys:

. . . Where is the disputed area?

The Interior Department recognizes the "Chapman line" drawn in 1951 by then Secretary of Interior Oscar Chapman as Louisiana's coastal boundary. This line, drawn for administrative purposes, follows roughly the actual coast. The Interior Department claims Louisiana has jurisdiction only 1 marine league (about 3½ miles) beyond that line.

The state, on the other hand, claims its coast extends out to the "Perez line" adopted by the legislature in 1954. It claims jurisdiction 3 leagues beyond that. In some places the Perez line is nearly 30 miles south of the Chapman line.

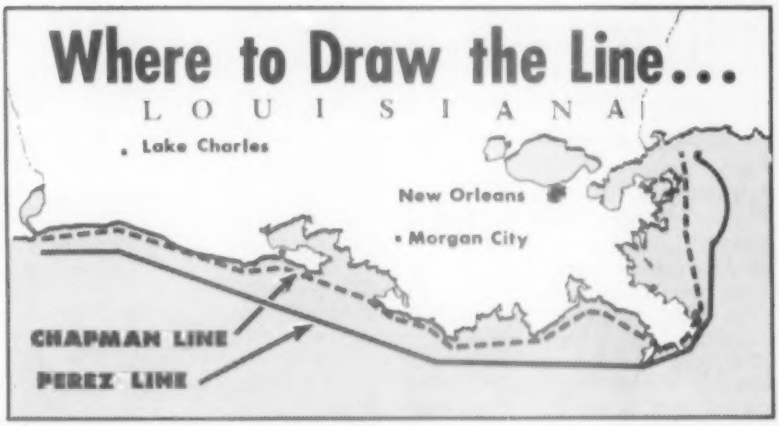
. . . What does the Supreme Court mean by "drilling" new wells?

Do you "start" a well when you erect a platform, when you get a drilling permit, or when you actually start turning the bit? Under a strict interpretation of this order, there would be a lot of idle platforms sitting out in the gulf. Some of them would be abandoned without ever having a rig installed.

. . . Supposing Louisiana and the federal Government reached an agreement of further development, even on a limited scale?

Will one of the Supreme Court justices be available during the vacation season to validate the agreement? If so, will he be empowered to do so?

Under strict interpretation of the Supreme Court order, oil companies are not involved. Apparently they are not directly forbidden to drill. The anti-drilling section of the order is directed at Louisiana and the United States, neither of which has ever drilled a well in the Gulf of Mexico.



QUESTION OF LOUISIANA'S boundary line is nearing a crisis of confusion. The federal Government recognizes the Chapman line. It roughly follows the coast with Louisiana's jurisdiction extending 1 marine league beyond. Louisiana says its coast extends to the Perez line which in some cases is nearly 30 miles beyond the Chapman line. State claims jurisdiction 3 leagues beyond that.

However, companies find little consolation in this technicality. They have a tenant-landlord relationship with the government agencies. If their landlords are forbidden to drill, it is generally assumed that the tenants also will be restrained.

In a few cases in which companies have taken the precaution of paying rentals to both claimants of disputed tracts, chances of continuing exploratory drilling are considered slightly better.

There is some talk of an appeal to Congress to get a bill through to settle the boundary dispute. But there is little hope of success here since "everybody's politicking" in Washington these days.

State holds trump . . . There is a possibility—though perhaps a slim one—that some brave company will ignore Louisiana's "Perez" line and assume the disputed area to include only that strip between 1 league and 3 leagues of the Chapman line.

"However," cautioned one operator, "the State of Louisiana isn't going to ignore it. That's for sure."

According to this view, Louisiana is likely to capitalize on the opportunity to establish its jurisdiction as far seaward as it was proclaimed in the 1954 boundary law. In a showdown, Louisiana could halt practically all oil activity in the disputed district by posting guards at Morgan City, Cameron, Grand Isle, Venice, and a few other supply ports.

Under stringent interpretation of what comprises the disputed area, practically all drilling might be interrupted off Louisiana. Of the 86 rigs operating off Louisiana's coast last week, approximately 60 were behind the "red-tape curtain." In addition, an estimated 15 to 20 drilling locations had been announced for that area.

A few fields in the Bay Marchand, South Pass, West Delta, and Eugene Island areas are shoreward from the disputed strip, being clearly within Louisiana jurisdiction. Beyond the disputed strip, production is scarce, coming mostly from the CATC Group's Block 192 field in West Cameron and from Gulf Refining Co.'s Block 154 field in the Ship Shoal area. Even the latter might fall partially within the no-drilling zone.

Sidney M. Groom, Jr., manager of the Interior Department's outer Continental Shelf office here, predicted that the federal Government would hold no further lease sales off Louisiana until December or January. Some oil men doubt that the Supreme Court will rule on the boundary dispute even by that time. They are talking in terms of a possible 8-month delay in operations within the affected strip.

A delay of such length could put some small companies out of business. Even the majors would be hard hit by interest on their huge investments in idle equipment.

Magnitude of the idle-investment problem is clearly illustrated by the inventory of the CATC Group. This four-company combine has approximately 20 platforms either under construction or waiting to be moved to drilling location. Since most of the equipment was designed for specific water depths and footings at leases in the disputed area, it is doubtful that much of it would be suited to operations beyond that strip.

Super Octane to Spread

Other companies may join Sun and Jersey affiliates this summer in selling new 100-octane super-premium gasoline

BRADFORD, Pa. — Several companies may soon follow the lead of Sun Oil Co. and the Standard Oil Co. (N. J.) group in marketing a new 100-octane premium gasoline.

"A surprising number of companies this summer will begin marketing a third grade, or super premium, tailored especially to the needs of the most demanding of the current automobiles," a well-informed spokesman predicted last week.

H. W. Grote, assistant manager of the research and development laboratories of Universal Oil Products Co., Des Plaines, Ill., said the industry is on the threshold of an era of substantial 100-octane demand. He addressed the thirty-third annual meeting of the Pennsylvania Grade Crude Oil Association.

Present 97 to 98-octane fuel still won't give knock-free performance in 15 to 20 per cent of the 1956 model cars having the highest-compression engines. Hence, the U.O.P. scientist said, refiners must be ready to gear gasoline output to produce a significant proportion of very high-octane product.

Route to octanes . . . The gasolines produced by fluid catalytic cracking are generally of high enough quality to be used in reasonable concentration in premium-quality fuels today.

But the super-quality fuels of tomorrow are another story. They will tolerate a much lower percentage of fluid catalytic gasoline.

"It is therefore probable that this product will be used largely in regular-grade fuel along with polymer gasoline," Grote said.

The trend toward ultrahigh octanes points to greater use of catalytic reforming, alkylation, and isomerization.

Catalytic reforming . . . Cat-reforming units now total 11 per cent of the nation's crude capacity, and some expect the ratio to exceed 40 per cent by 1960.

Cat reforming is already being used to produce 100-octane leaded gasolines. The first commercial U.O.P. Rexformer has gone on stream and is making 98 to 100-octane clear. Two others are scheduled to start operating later this year.

New catalysts also will have an important role in bolstering the refiner's high-octane pool. Improved Platforming catalysts recently announced are raising the yield of reformate.

"The R-8 catalyst, of higher platinum content, has been developed for certain specific high-octane applications, and will be utilized soon in commercial operations," Grote said.

Catalytic reforming is applied largely to the heavy ends of low-quality feed gasoline. As the level of the octane pool is increased, the low-boiling straightrun gasoline must be upgraded by other means.

Isomerization . . . Here's where isomerization comes in.

U.O.P.'s Penex process, announced recently, is one of the new processes developed to convert the low-octane pentane and hexane fractions into valuable gasoline components. This isomerization process can improve the low-grade feeds by 8 to 10 octane numbers.

The reaction is carried out in the presence of hydrogen, supplied by reforming units. Only a small amount is required. The process produces a high yield of liquid products at mild operating conditions and without catalyst regeneration.

Results with pentanes . . . The Penex process will raise the clear octane of pentanes by 10 to 11 numbers and the leaded rating by 7 to 8 numbers. Ninety-nine per cent of the feed is recovered as the high-octane product (see table).

The recycle operation involves fractionation of a mixture of fresh feed and reactor effluent. It produces an isopentane overhead distillate of the desired properties along with a bottoms fraction for charging to the Penex reactor.

A minor portion of the pentane splitter bottoms stream is fractionated to remove the small amounts of hexanes introduced with the fresh feed.

Results with hexanes . . . Hexanes are upgraded by 12 octane numbers clear and 9 numbers leaded with a yield of 97 per cent of the fresh feed from the Penex unit (see table).

As hexane fractions vary in composition from plant to plant, methods of processing will be different.

In a simple once-through processing of hexanes, the first step is fractionation to separate the low-boiling, generally high-quality isomers. The heavier, low-octane hexanes are then processed once through the Penex reactor.

The reactor product is stabilized and blended with the low-boiling isomers. A recycle operation will upgrade hexanes to a leaded research octane above 96. But it is more expensive. It involves returning the stabilized reactor effluent to the feed hexane splitter.

With some hexane fractions the addition of an aromatic-separation step will produce a total product with leaded research octane above 100. The overall yield is 93 per cent of fresh feed, and the product rating is 101 leaded octane, 10 to 11 numbers higher than the feed. These results are possible with hexane fractions containing substantial amounts of cyclic hydrocarbons—naphthenes and benzene. With aromatic separation, the hexanes are converted to high-octane isomers and the naphthenes to benzene.

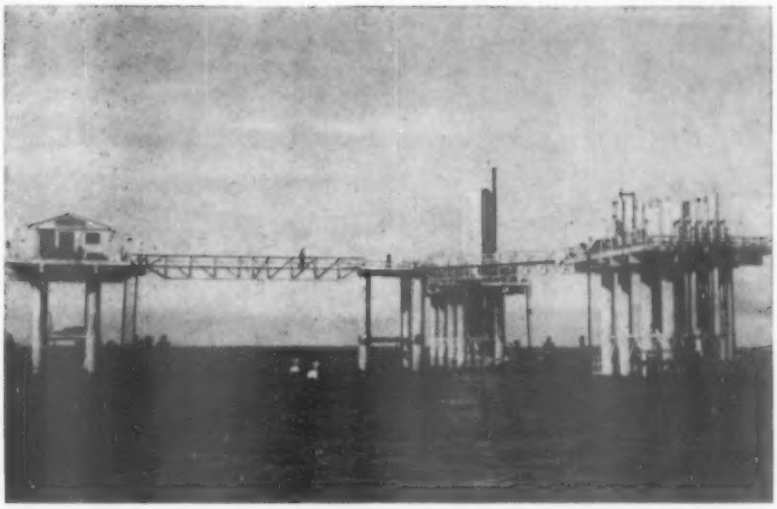
The test using aromatic extraction was with a feed stock having a clear octane of 69.7 and 90.2 leaded. Nonaromatics, making up 69.8 per cent of the fresh feed, had octane ratings of 84 clear and 98.8 leaded. Benzene produced was equal to 23.5 per cent of the feed. This product had ratings of 100 and 108, respectively. The total liquid product tested 88 octane clear and 100.8 leaded.

PENEX PROCESSING OF HEXANES ONCE-THROUGH

	Feed, mixed hexanes	Hexane splitter overhead	Stabilized reactor effluent	Total product liquids
Yields, volume per cent	100.0	42.5	54.5	97.0
F-1 octanes				
Clear	62.0	78.8	71.0	74.4
+ 3 cc. TEL/gallon	85.0	96.0	92.0	93.8
R.v.p.	6.1	7.5	7.5	7.5

PENEX PROCESSING OF PENTANES

		Products		
	Feed, mixed pentanes	Isopentane fraction	Hexanes and heavier	Total product liquids
Yields, volume per cent	100.0	93.0	6.0	99.0
F-1 octanes				
Clear	79.2	91.3	83.1	90.9
+ 3 cc. TEL/gallon	95.2	102.8	96.8	102.7
R.v.p.	18.2	21.7	12.4	21.1



PRODUCTION PLATFORM, one of several in South Pass Block 24 field is sign that . . .

No. 1 Gulf Field Growing Fast

NEW ORLEANS.—An offshore oil field near the mouth of the Mississippi River, already the biggest producer in Louisiana, soon will have an elaborate gathering system to facilitate future development.

South Pass Block 24 field will be linked to a network of oil and gas pipelines being installed by Shell Oil Co. *(The Oil and Gas Journal, December 12, 1955, page 67).* The offshore gathering system is expected to be completed about midsummer.

When completed, the $3,830,000 gathering system will connect at least nine production platforms in Blocks 24 and 27, South Pass area, and Dixon Bay, which recently was combined with Block 24 field. The Block 24 production platform pictured above rests on concrete piling and stands about 40 ft. above the water.

Crude gathered from the offshore platforms will be piped to a big storage terminal which Shell is building on the Southwest Pass of the Mississippi. In addition to the crude-gathering facilities, Shell's underwater pipeline system will include a network of gas lines connecting several offshore fields with Tennessee Gas Transmission Co.'s Muskrat line now under construction.

Shell, which discovered Block 24 field in 1950, is the largest of three operators there. The company now has more than 125 producing oil wells in the field.

Field takes lead . . . The field spurted into the lead as the state's biggest oil producer last fall when about 30 wells in Dixon Bay field were annexed to it.

After the annexation, production soared to 31,700 bbl. daily as compared to 24,500 bbl. daily for Caillou Island in Terrebonne Parish, the state's second largest producer.

But so spectacular has been the field's growth that it now has almost twice as many producing wells as it had when it moved into first place. Daily production now, even after recent proration cuts, averages about 40,000 bbl. Meanwhile, Caillou Island output has remained around 25,000 bbl. a day.

Block 24 is one of the few so-called "major" oil fields discovered offshore. Its reserves have been estimated at well over 100,000,000 bbl. Today it is probably still the fastest growing field in Louisiana, both in the number of producing wells and in crude production.

How output has grown . . . Current output is nearly double the average of 1955. At the end of 1953 the field had 27 producing wells. The number climbed to 81 by the end of 1954 and to 186 by the end of 1955. During the first 3 months of this year the number rose another 56, bringing total producers to 242.

Although the entire field is classified as offshore, the productive area actually extends a short distance under the mainland.

Latest figures compiled by the Louisiana Department of Conservation list 124 wells in the field operated by Shell, 110 by The California Co., and 8 by The Texas Co. These figures, however, were for last March. That month, Shell produced 720,177 bbl. of oil from the field compared to California's 546,119 and Texaco's 56,100.

New Region Opened

Nebraska gets its first Cambridge arch producer

McCOOK, Neb.—The Nebraska portion of the Cambridge arch has its first commercial oil production.

M. P. Gilbert 1 Barger, 10 miles northwest of McCook, was completed late last week for a pump gage of 198 bbl. of oil per day. Produtcion was from Kansas City lime-Pennsylvanian perforations at 3,856-64 ft. It is the first production in Red Willow County and first production on the Nebraska side of the Cambridge arch.

This wildcat is one of four important tests in the Cambridge arch region in recent weeks. Earlier this month wildcats in Thomas, Rawlins, and Decatur counties in Kansas to the south of Red Willow County opened new producing areas. The region is lonely wildcat land between the Las Animas arch and the Cambridge and Central Kansas uplifts.

The Red Willow County discovery now forces a new look at the possibilities of the Cambridge and Chadron arches of Nebraska. These structures are relatively untested Mid-Continent features. But it is believed they hold potentialities similar to prolific Central Kansas uplift areas.

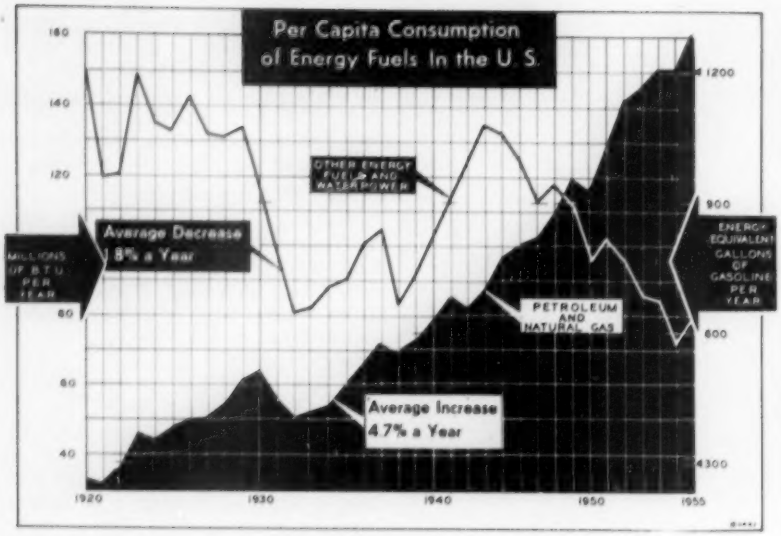
Last year a wildcat in Hitchcock County, southwest of Gilbert's discovery, indicated commercial oil production, but was abandoned after several months of testing.

This region of northwestern Kansas and southwestern Nebraska is believed one of the future petroleum provinces of the country. Based on the success of recent wildcats in Kansas and the newest addition in Nebraska, it appears that 1956 will be a year of big exploratory news in the northern Mid-Continent wildcat country.

Reformers, Alky Unit Set

NEW YORK.—Esso Standard Oil Co. will build two Powerforming units and an alkylation unit in two East Coast refineries.

At Everett, Mass., a 7,000-bbl. per day Powerforming unit has been contracted by Badger Process Division of Stone & Webster Engineering Corp. At Esso's Bayway refinery, Linden, N. J., the company will build a 20,000-bbl. Powerformer and an alkylation unit with initial capacity of about 5,000 bbl. The unit will have an eventual capacity for producing 8,000 bbl. of alkylate per day, depending on availability of butylene and isobutane feed stocks.



Charts tell the story of . . .

. . . Shift in Energy Fuels

THE sharp rise of petroleum and natural gas as energy fuels has resulted largely from their replacement of other energy sources, annual data on the subject indicates.

To measure the exact degree of the interfuel shift would call for much more information than is now available. But the accompanying table and chart clearly point up the displacement trend.

The table on consumption of energy fuels and water power was compiled by the Bureau of Mines and differs from previous reports in that it shows consumption rather than production. The totals are in trillions of British thermal units per year.

Total consumption of energy fuels and water power climbed from 19,768 $\times 10^{12}$ B.t.u. in 1920 to 39,668 $\times 10^{12}$ for 1955. These totals represent an average gain of about 2.0 per cent a year. Population increases in the United States for the same period averaged almost 1.3 per cent a year, and per capita consumption inched up at the rate of 0.7 per cent a year.

What's happening . . . These over-all gains are dwarfed by the percentage gains for petroleum and natural gas.

The volumetric increases in total consumption of petroleum and natural gas averaged 6.0 per cent a year for the 1920-55 period, and the per capita gains 4.7 per cent a year.

The increases reported for all fuels do not represent net gains in total energy consumption since there was some replacement of other energy materials. In the period of 36 years, tractors replaced many horses and mules on farms of the country, and there was some drop in the consumption of firewood.

Some replacements within the group of fuels listed are definitely indicated by the demand figures in the table. Note that the 1955 totals for both bituminous and anthracite coal were less than in 1920. Anthracite demand in 1955 was less than a third of consumption in 1920.

Per capita consumption of petroleum and natural gas amounted to 32,770,000 B.t.u. in 1920 and had risen to 160,479,000 B.t.u. for 1955. The total gain is about 390 per cent. In contrast, other heat fuels and water power dropped from 152,897,000 B.t.u. in 1920 to 79,933,000 B.t.u. in 1955.

What it means . . . The unusually large gain for petroleum and gas, combined with the loss for other fuels, is definite proof that part of the increase for oil and gas was due to replacement of other fuels.

When this replacement process slows up, the gains for petroleum and natural gas will tend to drop back a little nearer the gain rate for total energy use.

Even with greater annual increases in population, the rate of gain in demand for oil and gas over the next 35 years will not equal the average annual increase of 6.0 per cent for the period 1920-55.

Consumption of Energy Fuels and Energy From Water Power*

	Trillions of British thermal units per year					
	Bituminous coal	Anthracite coal	Petroleum and products	Natural gas, dry	Water power	Total
1920	13,325	2,179	2,676	813	775	19,768
1921	10,266	2,082	2,724	669	656	16,397
1922	11,185	1,443	3,127	771	675	17,201
1923	13,598	2,208	4,120	1,014	727	21,667
1924	12,681	2,050	3,867	1,149	685	20,432
1925	13,079	1,627	4,280	1,191	701	20,878
1926	13,954	1,961	4,480	1,311	765	22,471
1927	13,095	1,897	4,556	1,438	815	21,801
1928	13,069	1,871	4,963	1,559	890	22,352
1929	13,612	1,815	5,540	1,906	847	23,720
1930	11,921	1,718	5,895	1,932	785	22,251
1931	9,743	1,484	5,165	1,679	692	18,763
1932	8,041	1,283	4,748	1,555	726	16,353
1933	8,323	1,260	4,988	1,558	729	16,858
1934	9,008	1,410	4,979	1,773	721	17,891
1935	9,336	1,298	5,668	1,919	831	19,052
1936	10,697	1,351	6,308	2,173	841	21,370
1937	11,286	1,280	6,812	2,417	905	22,700
1938	8,811	1,148	6,674	2,298	899	19,830
1939	9,854	1,262	7,062	2,474	872	21,524
1940	11,290	1,245	7,730	2,665	917	23,847
1941	12,893	1,338	8,568	2,784	975	26,558
1942	14,149	1,435	8,034	3,028	1,177	27,823
1943	15,557	1,450	8,607	3,397	1,347	30,358
1944	15,447	1,509	9,703	3,678	1,387	31,724
1945	14,661	1,311	10,110	3,871	1,486	31,439
1946	13,110	1,369	10,480	3,982	1,446	30,387
1947	14,302	1,224	11,367	4,386	1,459	32,738
1948	13,622	1,275	12,557	4,901	1,507	33,862
1949	11,673	958	12,119	5,145	1,565	31,460
1950	12,900	1,013	13,489	5,969	1,601	34,972
1951	12,285	940	14,848	7,049	1,592	36,714
1952	10,971	897	15,334	7,550	1,614	36,366
1953	11,182	711	16,098	7,907	1,550	37,448
1954	9,512	683	16,132	8,330	1,479	36,136
1955	11,090	605	17,509	8,970	1,494	39,668

*Bureau of Mines.

Indiana Wins Suit

Ohio Standard loses use of Sohio name in Midwest

CHEYENNE, Wyo.—U. S. District Court here has granted an injunction asked by Standard Oil Co. (Ind.) prohibiting Standard Oil Co. (Ohio) from using the marketing trade-name Sohio in a 15-state area served by the Indiana firm.

"The letters S.O. have always stood for Standard Oil and . . . it is a trademark belonging to the plaintiff and entitled to exclusive use in its territory," Judge T. Blake Kennedy ruled following a 35-day trial—longest in the court's history.

Indiana Standard had charged Standard of Ohio with trademark infringement and unfair competition. The former company sought damages and a permanent injunction. Standard of Ohio, in a cross-complaint, demanded summary judgment, accounting and damages.

The judge denied all damages and limited the injunction to marketing. He said use of the name Sohio in production, manufacturing, and transportation would not result in confusion.

Standard of Indiana's marketing area covers Colorado, Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Montana, Nebraska, North Dakota, Oklahoma, South Dakota, Wisconsin, and Wyoming. Standard of Ohio markets principally in Ohio and Kentucky.

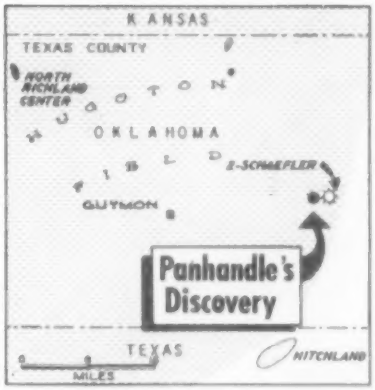
As to the adoption of the name Sohio in lieu of another trade-name, Judge Kennedy noted:

"The answer would seem to be that the party selecting such a name intends in some way to share in the good will and the developed market of a dealer in the same class and thereby reap some sort of benefit by deception of the public mind."

Well Confirms Discovery

JACKSON, Miss.—The confirmation well to the important Lower Cretaceous discovery in Hancock County on the Mississippi Gulf Coast seems assured of success. Marshall R. Young, et al., are drilling at 11,123 ft. after testing shows at the 1 International-Alexander, a half mile northwest of the discovery; a Washita-Fredericksburg producer.

A good blow was reported on drill-stem test at 10,828½-62 ft., but no top pressure was reported. Mechanical troubles plagued the operators after the tool was closed and crews reversed out an unestimated amount of oil. The mud and muddy-water cushion was heavily oil and gas-cut. Still on the tool was 360 ft. of 39°-gravity oil.



New Hugoton Strike

Ballew-area discovery may be field's biggest to date

GUYMON, Okla. — Panhandle Eastern Pipe Line Co. has what is probably the biggest "inside Hugoton" discovery to date at its 2-24 Ballew, about 15 miles east of Guymon in Texas County, Oklahoma Panhandle.

The deep Morrow - Pennsylvanian sand discovery flowed 1,000 bbl. of oil per day and 80,000 M.c.f. of gas from perforations at 6,256-96 ft. on tests. One test flowed 200 bbl. of oil per hour through open casing.

Panhandle's nearby 2 Schaefler flowed 7,012 M.c.f. of gas per day from perforations at 6,289-6,333 ft. in the Morrow on initial tests. The Ballew area also got another location last week at 3 Ballew.

The 2-24 Ballew discovery is the most significant development inside Hugoton field since North Richland Center field was opened several months ago on the west side of the Permian shallow gas-producing area.

Location of Panhandle's Ballew area is on the east side of the vast gas field. Nearest Morrow production is to the southeast at big Grand Valley-Camrick field.

The discovery is part of Panhandle Eastern's 60-well drilling program planned in the Hugoton area *(The Oil and Gas Journal, May 14, page 224).*

Kermac Scores in Louisiana

NEW IBERIA, La.—A promising new pool has been opened in the Atchafalaya swamp, 15 miles northeast of here, by Kerr-McGee Oil Industries, Inc.

The discovery well, 1 Schwing B, flowed 597 bbl. of 41.9°-gravity oil on a 24-hour test through a 6/64-in. choke. Total drilling depth was 13,665 ft., with perforations made at 12,870-85 ft. in the lower portion of the producing sand.

Gas-oil ratio was 2,570:1. Flowing tubing pressure was 4,800 psi., decreased by an estimated 3,000 psi. by special subsurface equipment in the tubing. Calculations indicate shut-in pressure will be in excess of 8,000 psi., with bottom-hole pressure in the range of 11,000 psi.

The well is 4 miles northwest of Lake Chicot field, site of the nearest production.

Price of Crude Cut

Reductions posted by five buyers of Illinois supply

CLEVELAND.—The posted price for Illinois crude was reduced 10 cents a barrel June 12 by Sohio Petroleum Co., subsidiary of Standard Oil Co. (Ohio). Four other companies quickly followed suit.

Together, they purchase some 60 per cent of crude affected by the lower prices.

Sohio is the biggest purchaser, with an estimated 85,000 bbl. a day. Ashland Oil & Refining Co., which posted its new prices June 15, accounts for some 70,000 bbl., and the other three companies in the move add about 22,000 bbl.

This totals 177,000 bbl a day. Total production in the Illinois basin averages almost 300,000 bbl. daily.

A Sohio official explained the company's action this way: "This price adjustment will partially restore the competitive position of Illinois-Kentucky-Indiana crudes in relation to other crude oils available in substantial volumes to Sohio refineries."

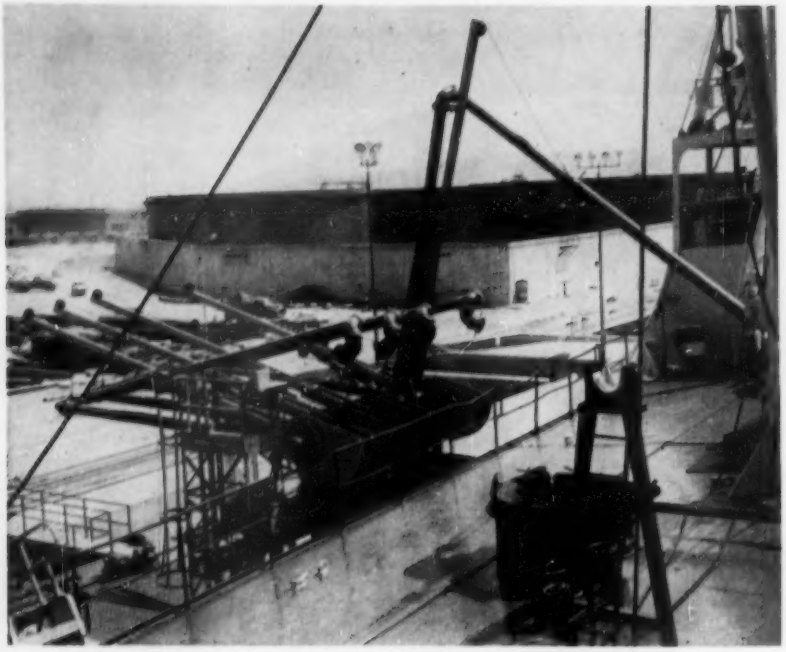
Rate-Case Load Jams FPC

WASHINGTON.—The Federal Power Commission is catching up with its backlog of certificate filings by independent gas producers. But it's steadily falling behind in disposing of rate cases.

A total of 340 rate applications was filed in May, the FPC reported last week. It allowed 12 tax rate and 26 other increases and 4 decreases, and suspended 12 increases. In April 288 cases were filed, of which 55 were allowed and 7 suspended.

At the end of May, the FPC had 206 suspensions totaling $17,852,713 a year, against 196 totaling $18,396,402 at the start of May.

The commission is disposing of certificate filings at a rate about five times that of receipts. A total of 111 applications came in during the month. But 568 certificates were issued and 83 cases were otherwise disposed of. The backlog dropped to 3,225 at the end of the month from 3,765 May 1.



Marine Loading Unit Operating

LOS ANGELES.—The first of three five-arm marine loading units went into operation last week at Richfield Oil Corp.'s $5,000,000 marine terminal now under construction at Long Beach.

The Chiksan units permit handling of several products or crudes simultaneously without contamination.

Each unit has five 8-in. aluminum dock hoses with aluminum swivel joints. A hydraulic system permits a single operator to swing the hoses to the tanker for flanging up.

Hoses can be installed singly or in multiples. The units are engineered to allow a 40-ft. rise and fall of the tanker and a 20-ft. fore and aft drift.

The system eliminates dock hoisting equipment, manual handling of heavy hose, bursting of hose, and costly cleanups.

Richfield's new terminal, which is slated for completion in November, consists of three 300-ft. concrete and steel docks, spaced to permit loading operations on two supertankers and one T-2 tanker at the same time.

Richfield has also installed air-operated capstans and tuggers for handling mooring lines.

Dow Plans Purchase, New Plant

MIDLAND, Mich.—Dow Chemical Co. has taken an option to purchase Bay Refining Corp. and its associate, Bay Pipe Line Corp., both of Saginaw, Mich.

If the deal goes through, Dow will also build a major petrochemicals plant in Bay City, about 20 miles east of here. It would be on Dow-owned property adjacent to the 9,000-bbl. Bay refinery, from which it would pipe ethylene and other byproducts. Ethylene is a basic building block in the manufacture of Dow plastics.

The petrochemicals plant is expected to go into operation late in 1957. It would be coordinated with the Dow facilities here.

Bay is a closely held company, whose sales are expected to reach $15 million for the fiscal year ending September 30. Bay is processing Canadian crude.

The pipeline company's sales may reach $10 million for the fiscal year. It operates a crude-oil system with connections for large supplies from the United States and Canada.

No change in operations of the Bay companies is being considered, according to W. Rolland Stewart, vice president and general manager of Bay Refining.

"We plan to continue our present activities in the refining and distribution of gasoline and burning oils indefinitely, and expect to maintain our favorable position in the northern Michigan and Thumb area markets."

W. H. Schuette, Dow's Midland division general manager, said his company is planning a "major capital investment" in developing the Bay City petrochemicals operations.

Gas Data Demanded

Douglas wants FPC to get reports from independents

WASHINGTON.—A demand that independent gas producers be required to report their production, gas reserves, and capital A operating costs to the Federal Power Commission was renewed last week by Sen. Paul H. Douglas of Illinois.

Douglas told the Senate he had tried to have the FPC call for this data in its May 11 order requiring annual reports of gas sales.

Its failure to do so, he said, is "a serious refusal to carry out the duty given to it by the Natural Gas Act and clearly spelled out in the decisions of the U. S. Supreme Court."

The information he wanted "will be helpful to Congress in its further consideration of natural-gas legislation," Douglas told FPC Chairman Jerome K. Kuykendall.

"I am reluctant to believe that, despite the provisions of the law and the court decisions which, after lengthy litigation, clearly lay the responsibility on the commission, you would now once again decide to tie your own hands by failing to secure the necessary factual data."

Douglas suggested that the FPC "is yielding or bending to the kind of industry pressures which were so evident during the debate on the natural-gas (Harris-Fulbright) bill."

"We believe the FPC should go on with its job and not shirk it any longer," the senator said.

Detroit Decision Upset

WASHINGTON.—The House last week overturned a Supreme Court decision that price-cutting to individual customers, in good faith to meet the lower prices of a competitor, is not a violation of the Robinson-Patman Act.

But there was no immediate indication that the Senate would concur in the House action—this year at least.

The Supreme Court decision, long under attack by small-business defenders in Congress, was handed down in 1953 in the Standard Oil Co. (Ind.) "Detroit" case.

A "modified" order issued by the

Federal Trade Commission under that decision was held invalid last month by the Chicago Circuit Court of Appeals *(The Oil and Gas Journal, May 14, page 104)*.

A number of bills to revise the good-faith provision were introduced last year. The measure passed by the House—by a 393-3 vote—makes the plea of good faith complete only if the seller can show that his price differentials do not "substantially lessen" competition or tend to create a monopoly.

With the end of the session near, the bill could reach the Senate floor for action this year only if reported without hearings. Supporters of the restriction are urging that this be done. But a large number of groups have asked for hearings at which they can oppose the bill.

Bill Wins Support

Interior for law to limit military land withdrawals

WASHINGTON.—A bill to curb land withdrawals by the military was given the support of Interior Department officials last week.

Under present laws, there is no limit on the size of tracts that may be reserved by presidential order for military uses, such as missile ranges, training, etc. The proposed bill would limit such withdrawals to 5,000 acres. Larger withdrawals would have to receive congressional approval.

Rep. Clair Engle of California, chairman of the House interior committee, introduced the measure following disclosure some months ago of the Navy's plan to test San Nicolas Island as a possible new naval petroleum reserve. The Navy dropped the idea, for this year at least, when the House appropriations committee refused to grant the $529,000 asked for the initial work.

The bill would restrict withdrawals both on the uplands and in the outer Continental Shelf. It would halt a Defense Department plan to take over several thousand square miles of the Gulf of Mexico for ranges, training, and other purposes.

The measure was approved by Edward Woozley, director of the Bureau of Land Management, at a hearing before Engle's committee. Woozley said it would "clarify" a situation arising out of the Defense Department's effort to have some 35,000,000 acres of Continental Shelf lands withdrawn. Opposition of the Interior Department caused the military to reconsider its plan, which it was feared would take large acreages of potential oil lands.

Senate Launches Lobby Probe

WASHINGTON. — Investigation of lobbying in connection with the Harris gas bill got under way last week.

The special Senate lobby committee named eight organizations as its first targets. But Chairman McClellan of Arkansas said the inquiry would not necessarily be limited to that group.

Four of the organizations worked for passage of the bill to exempt independent gas producers from federal regulation. They were the Committee for Pipeline Companies, the Mid-Continent Oil and Gas Association, the Natural Gas and Oil Resources Committee, and the Joint Committee of Consumers and Small Producers.

The other four worked for defeat of the bill. They were the United Automobile Workers of America (CIO-AFL), the Council of Local Gas Companies, the Mayor's Committee on Natural Gas, and the National Institute of Municipal Law Officers.

Although an appeal was issued to all members of Congress to submit any information they had that might have a bearing on lobbying activities, fewer than 50 have responded, McClellan disclosed. And only three or four offered data of any importance, he said.

The probe committee was set up as a result of the Case incident. The South Dakota senator, just before the Senate voted on the Harris bill, disclosed that he had been offered a $2,500 campaign contribution by an oil company.

The committee's inquiry is not limited to the activities for and against the gas bill. But it has not indicated whether it will go into lobbying in connection with other bills in which various industries, labor, and agriculture have deep interest.

Plants Taking Shape at Pincher Creek

PINCHER CREEK, Alta.—The cycling and sulfur plants which will handle the wet, sour gas of Pincher Creek field are going up in southwestern Alberta after delays caused by bad weather.

The facilities are being built by Canadian Gulf Oil Co., discoverer of the huge field which will be a big supplier for Trans-Canada Pipe Lines, Ltd., in which Canadian Gulf is a partner. Stearns-Roger Engineering Co. is contractor on the cycling plant and Ralph M. Parsons Co. on the sulfur plant.

In the left foreground are foundations of the still building, valve and scrubber buildings, and the compressor building. The installation is schedu'ed to start operating about October 1, producing 225 long tons of sulfur and 2,200 bbl. of condensate daily.

During the first year of operations, before Trans-Canada starts taking Pincher Creek gas, residue gas will be reinjected into the reservoir. When the field is linked to the gathering system, Canadian Gulf will sell 100,000,000 cu. ft. daily of residue gas to Trans-Canada the first year and 170,000,000 cu. ft. daily thereafter.

When facilities are expanded to meet Trans-Canada's needs, daily production will be 450 long tons of sulfur, 720 bbl. of propane, 770 bbl. of butane, 550 bbl. of natural gasoline, and 4,590 bbl. of condensate. The next expansion, to be made before gas deliveries are increased, will bring daily output to 780 long tons of sulfur, 1,230 bbl. of propane, 1,300 bbl. of butane, 1,020 bbl. of natural gasoline, and 7,810 bbl. of condensate.

Gas Well on Rampage

No fire yet, but toppling platform forces abandonment of Louisiana offshore well; loss expected to hit $2 million

ABBEVILLE, La.—A raging gas well, which blew out of control off the coast of Louisiana, last week forced the drilling crew to abandon the toppling platform and equipment valued at nearly $2,000,000.

On June 14, a full 6 days after the well went out of control, the platform and derrick were reported listing at an angle of about 20°. If the platform leans another 2°, one observer speculated, the derrick will topple.

The well is Union Oil Co. of California's A-1 O.C.S.-O297, in Block 26, Vermilion area. A wildcat, it was being drilled by Loffland Bros. in 25-ft. water, about 7 miles south of Pecan Island field.

A spokesman for Union Oil said gas, distillate, and salt water gushing from the well were digging out from around the platform piling.

All men were removed to safety when the platform started settling into the gulf bottom. At last report one corner of the platform had sunk about 8 ft.

Although the gas had not burst into flames, Myron M. Kinley, world-renowned oil-well fire fighter, was flown from Houston to attempt to kill the well.

Kinley was able to open blowout preventers in an effort to divert the flow straight up. When this failed to change the course of the gas, Union officials ordered the withdrawal.

Immediately, the company started searching for new offshore drilling equipment to put down a directional hole in another attempt to kill the doomed well.

Ironically, the lease is in the disputed area within which the U. S. Supreme Court last week ordered a temporary ban on the drilling of any new wells.

One company spokesman indicated the court order will be ignored so the blowout can be checked as quickly as possible. He remarked wryly that observance of the drilling ban probably would save money for the company.

The blowout was believed to be the most severe ever experienced by operators in the Gulf of Mexico. It occurred about 7 p.m. June 7 when the bit hit a high-pressure sand at 11,435 ft. By 2 a.m. the next day the well was out of control.

The flow apparently is coming from a rupture in two strings of casing below the bed of the gulf. In addition to surface casing, 9⅝-in. protective pipe had been run to 10,500 ft.

Salt-water vapor shooting above the platform was visible for miles.

Stanolind Oil & Gas Co. owns half-interest with Union of California in the lease where the blowout occurred. However, Union had sole responsibility for drilling the first well under terms of its farmout agreement.

Drilling equipment recently was moved back to deepen the now-abandoned well after a second test had been drilled directionally to 10,000 ft. from the same platform.

The platform is owned by Union Oil, and the abandoned rig is property of the contractor.

Cost of the blowout has been estimated at more than $2,000,000, including additional expenses to be incurred in drilling a relief well. An undetermined amount of the loss is covered by insurance.

Butadiene Deal Hit

Congress asked to reject low bid for rubber plant

WASHINGTON.—Congress was asked last week to turn down the sale of the Government-owned alcohol butadiene plant at Louisville to Union Carbide & Carbon Corp.

The sale would take an important butadiene producer out of the synthetic rubber picture, the House armed services committee was told by Lawrence R. Brown, assistant to the president of Publicker Industries, Inc.

It also would eliminate a market for industrial alcohol made from surplus grain held by the Government, he said.

Brown pointed out that the attorney general disapproved the sale because Carbide does not intend to produce butadiene.

"A plant in operation is a greater national asset, and more readily available for emergency production than a plant on standby," he reminded the committee.

Publicker spent some $190,000 in improving the plant and another $700,000 to get it into operation, Brown said, even though the Government had refused to pay for equipment and improvements which will revert to it at the end of the lease.

The company was willing to meet Carbide's bid, Brown testified. He charged the Rubber Disposal Commission did not deal fairly with his company during the negotiating period.

Assistant Attorney General Stanley N. Zees also said the deal should be turned down.

There is no indication it violates the antitrust laws, he said, but neither will it further the purpose of the Rubber Disposal Act to create a competitive synthetic rubber industry.

Kellogg Gets Site

Plans polyethylene plant for new Phillips center

HOUSTON.—A second company has acquired a potential plant site in the multimillion-dollar petrochemical center being promoted here by Phillips Petroleum Co.

M. W. Kellogg Co. traded a 138-acre tract nearby for an area of equal size in the proposed petrochemical center. At the newly acquired site Kellogg is expected to construct a polyethylene plant using the Marlex process licensed by Phillips.

Kellogg thus became the second firm to acquire space in the 950-acre tract which Phillips has offered for resale to petrochemical manufacturers.

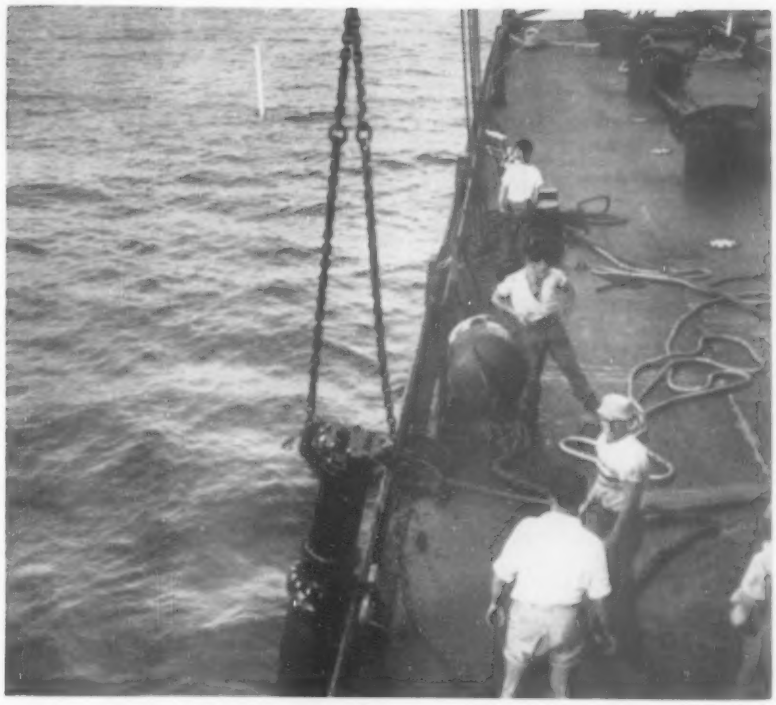
Celanese Corp. purchased 220 acres from Phillips and has started construction there of a plant designed to produce nearly 40,000,000 lb. of polyolefin resin annually *(The Oil and Gas Journal, April 2, page 74)*. Celanese will use the Phillips process in its manufacturing operation, which is expected to start early in 1957. Phillips also will provide ethylene as raw material for the plant.

The property which Phillips acquired from Kellogg is about 1½ miles east of the proposed manufacturing center near the Houston ship channel. Kellogg purchased about 93 acres there several months ago and later acquired an additional 45 acres in the same area. Phillips has made no announcement of its plans for the tract.

Employes to Choose Union

BAYTOWN, Tex.—The National Labor Relations Board has scheduled an election here June 28-29 to determine which labor union will represent more than 4,000 employes of Humble Oil & Refining Co.

Refinery workers will choose among the Baytown Employes Federation, the Metal Trades Council of the A.F.L.-C.I.O., and no collective-bargaining agent. Most of the workers have been represented for years by the independent Baytown Employes Federation.



CREWMEN start to hook up for unloading as . . .

Big-Inch Sea Line Put to Work

HUNTINGTON BEACH, Calif.—Wilshire Oil Co. inaugurated operations on its new $1,000,000 marine unloading line here recently. The first cargo—205,000 bbl. of Venezuelan crude—was delivered by the tanker Esso Stockholm.

Crewmen of the Stockholm are shown above preparing to attach the end of the unloading line to side of the ship. After this operation, two 10-ft. extensions are attached to the line connecting it with the ship's discharge manifolds.

Seen in the background of the photograph are a mooring line and a mast which locates the unloading line. The 24-in. pipeline is 12,000 ft. long. It lies on the ocean floor 7,000 ft. seaward from low tide, and the other 5,000 ft. runs from the shore line to three 170,000-bbl. tanks onshore.

The first unloading operation took 16½ hours. The discharge rate hit 17,000 bbl. an hour at times. Wilshire, however, expects to unload the same amount of crude in the future in less than 12 hours.

Wilshire's imports are expected to average 18,000 bbl. daily.

Polyolefin Process Launched

CHICAGO.—Standard Oil Co. (Ind.) has taken steps to commercialize its rigid low-pressure polyethylene process by issuing a license to Eastman Kodak Co. to manufacture the plastic.

James C. White, president of Texas Eastman Co., division of Eastman Kodak, said that the company will broaden its work in the field of high-density, low-pressure polyethylene. Eastman will build a semicommercial plant at Longview, Tex. Work will begin promptly and the first unit will be used for experimental production.

This project may eventually result in commercial production of the new product at Longview, White said. The existing Longview plant, built in 1950, was expanded to include a 20,000,000-lb. polyethylene unit in 1954. Early this year capacity was boosted to 40,000,000 lb. per year.

Process details . . . Indiana's process has the advantage of being a continuous one, it said, since the solid granular catalyst does not need regeneration. It can also be filtered out of the product and so gives polyethylene of low ash content.

Joseph K. Roberts, Indiana's general manager of research and development, said: "Our people showed how to make high-density polyethylene and polypropylene with a solid catalyst." They make possible a number of process advantages including long catalyst life and purity of product, he continued.

While the license to Eastman is not exclusive, Indiana Standard does not expect to embark on a general licensing program for the new process, Roberts added.

Lease Drive Pushed

Stanolind adds acreage in Delaware-Val Verde basins

MIDLAND. — Stanolind Oil & Gas Co. is continuing a drive for acreage in the promising Delaware-Val Verde basins area.

The firm has acquired a big 70,000-acre lease block in Terrell County on the Mexican border in Southwest Texas from Bassett Mineral Trust, San Antonio.

Stanolind paid a reported $2 per acre cash bonus for a 10-year lease expiring March 8, 1966. No drilling obligations were included in the agreement.

The acreage is roughly 10 miles northeast of Sanderson. It is in Block 148, T&StL. Survey; Block D, MK&T Survey; and Block 6, TT Survey.

The deal for the Terrell County leases follows two others Stanolind negotiated for 27,520 acres in Pecos County, which bounds Terrell on the northwest.

Some industry observers felt at that time that Stanolind was planning a major lease drive in the area *(The Oil and Gas Journal, May 28, page 94)*.

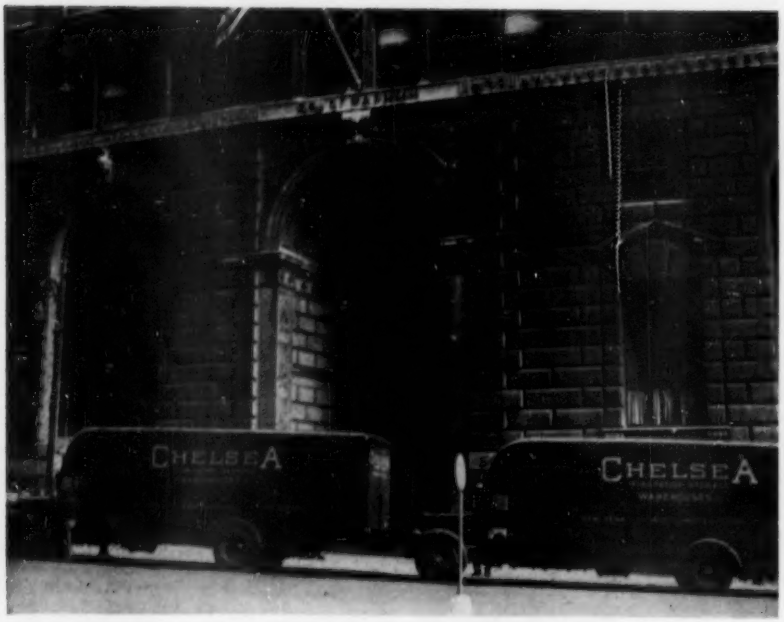
The Pecos acreage included blocks of 20,480 acres and 7,040 acres located roughly 20 miles southeast of Fort Stockton and west of the Puckett gas area.

Natural-Gas Storage Up

NEW YORK.—Underground storage capacity for natural gas reached 2,095,814,139 M.c.f. last year, the American Gas Association reports in its fifth annual survey.

Capacity was increased 237,000,000 M.c.f. over 1954, passing the 2 trillion cubic foot mark for the first time.

The A.G.A. estimated total investment in storage at $377,000,000. There were 178 storage pools and 6,746 active wells with five aquifer fields included. Ten new storage pools were being developed at the end of the year. Total output from storage last year was 352,000,000 M.c.f., of which some 271,000,000 M.c.f. was in Pennsylvania, West Virginia, Ohio, and Michigan.



It's Moving Day in New York . . .

. . . Stanvac Is Going Suburban

NEW YORK.—Standard-Vacuum Oil Co. has gone suburban. After nearly a quarter-century, the firm moved its headquarters last week from the famous old oil address at 26 Broadway, overlooking Battery Park in lower Manhattan, to the relative peace and quiet of nearby White Plains.

But the move wasn't designed for tranquility. It solves a problem faced by many other companies today: How to set up an efficient nerve center for distant and complex operations.

Stanvac, jointly owned by Standard Oil Co. (N. J.) and Socony Mobil Oil Co., Inc., has a big stake in letting its right hand know what the left is doing.

One of the nation's biggest customers of cable and radiogram services, the company coordinates operations in more than 50 countries in Asia, Africa, and Australia.

The modern new headquarters building is shaped like a giant Y, with swept-out wings in front and an elongated base at the back. There are 236,000 sq. ft. of floor space. Interior walls are movable.

A remote dictation-transcription setup speeds dictation. A letter, memo, or other message can be dictated at any one of 266 stations, which feed material to 28 recorders.

The typed letter or message will be returned to the sender's desk within minutes through a pneumatic tube which circles the building. The tube will also handle such objects as file folders, shuttling them direct to any of 25 receiving-dispatching points by a dial system.

Employes weren't forgotten, either. They can listen to soft music while they work, eat in a big modern dining room, enjoy the use of two recreation rooms, and control air conditioning in their individual zones.

Drill to Test City

Los Angeles clears way for restricted oil operations

LOS ANGELES.—Recent oil discoveries in suburban Los Angeles areas prompted civic officials last week to clear the way for drilling under city-owned property.

But the Los Angeles City Recreation and Parks Committee, in giving its nod of approval for drilling under city parks and recreation areas, tacked on several restrictions.

For one, drilling would be allowed only where danger of drainage by offsetting production exists. Another requires that revenue from successful operations under parks and recreation properties be used by the park and recreation department.

The matter came up when the commission was asked to make a recommendation on the possibility of slant drilling under Rancho Park in West Los Angeles from a drill site on the 20th Century Fox movie studio. Universal-Consolidated Oil Co. has already completed eight wells from a drill site on the movie lot. Universal's leases in the area adjoin Rancho Park.

The city attorney has ruled that the city may issue leases for drilling on park property providing the drill site is limited to one acre on an unimproved part of the property. Otherwise, wells bottomed under park property must be slant drilled from adjacent sites.

Before any leases can be issued, however, the city council must establish an oil-drilling district to include the park under exploration.

Increased public reception of this type of operation in the Los Angeles Basin has resulted largely from advanced development of derrick soundproofing and drill-site landscaping at Redondo Beach, Whittier, Culver City, Boyle Heights, and Universal's operations at the Fox movie lot.

Drill Plan Sought

Parley will set rules for California offshore wells

SANTA BARBARA.—The State Lands Commission and Santa Barbara County officials will meet here this week to work out an agreement on drilling regulations for 52,000 acres of submerged lands between Goleta and Point Conception.

District Atty. Vern Thomas of Santa Barbara requested the public hearing following the recent application by the C.U.S.S. group (Continental Oil Co., Union Oil Co., Superior Oil Co., and Shell Oil Co.) for bonus bidding on the acreage involved.

Thomas said he will ask the commission to use the regulations adopted for the Summerland parcel as a pattern for drawing up rules on the 52,000-acre area.

Under terms of the 500-acre Summerland lease, onshore sites must be landscaped and hidden from public view. Recreational and residential properties must be protected from damage. Other provisions in the lease deal with removal of equipment when a lease is abandoned.

The state has advertised for bids on the Summerland parcel. The bids will be opened June 26. This is the first submerged parcel to be put up for bidding under the new state law governing offshore oil development.

Work Starts on Gas Line

LOS ANGELES.—Construction has started on the Newhall-to-Alhambra phase of the recently approved natural-gas pipeline from Topock, Ariz., to Los Angeles.

This 49-mile segment of the 285-mile, 30-in. line is being built for the Southern California Gas Co. and Southern Counties Gas Co. by three contractors. The job was split three ways in order to get it completed before this winter.

Alex Robertson Co. is building 13.5 miles, Macco Corp. has the contract for 16 miles, and Joe E. Young Contractors, Inc., is working on a 19-mile phase. Completion for the whole 49 miles is slated December 1.

Work contracts on the 236-mile line between Newhall and Topock have not been awarded yet. Construction on this line is tentatively slated to begin by October 1.

Consolidated Western Steel is rolling the 30-in. pipe for the Newhall-Alhambra line at its new Provo, Utah, plant.

No final decision yet, but . . .

. . . Defense Pipeline Doubtful

WASHINGTON. — Competing plans of Texas Eastern Transmission Corp. and American Pipe Line Corp. for a Gulf-East Coast defense pipeline fall short of military objectives, it was indicated last week.

It was not indicated, however, why the military, which long has supported the idea of a pipeline to serve Atlantic coast refineries in the event tanker service was cut in time of war, feels that neither of the proposals is adequate.

Texas Eastern offered a line based on reconversion of the Little Inch pipeline. American proposed to build an all-new line. Both would carry products from the Gulf to the area around Pittsburgh, and the Government would have to build any line needed to continue the movement to the seaboard.

The proposals were discussed last September at a hearing before Mobilization Director Arthur S. Flemming. Flemming released a staff report on the matter in April and a tentative decision that the Government would not make any loan or commitment for the building of either line *(The Oil and Gas Journal, April 30, page 87)*.

Paul Ryan, chairman of American, challenged the ODM's findings and Flemming called on Hugh Stewart, director of the office of oil and gas, to answer.

Last week Stewart said that his original report against both proposals was based on a review of the facts. But there also were "elements of highly classified defense planning" involved.

Flemming made the letters public with an admission that he didn't know what the military facts were. He said he would call on the Interior Department for more detailed information.

He has no intention of holding another hearing, he said. When Interior gives him the full story, he will make a final decision.

Processing BRIEFS

OKLAHOMA CITY.—Anderson-Prichard Oil Corp. has awarded a contract for construction of a 5,000-bbl. fluid catalytic cracking unit at its 10,000-bbl. refinery in Cyril, Okla. Work will include construction of fractionation and light ends recovery facilities and revamping of existing units. Procon, Inc., is the contractor. Construction will start in July and be completed about March 1. The company is also revamping facilities at its Arkansas City, Kans., refinery.

CORPUS CHRISTI. — An 11,000-bbl. Platformer which will upgrade either straightrun naphtha or natural gasoline has gone on stream at Southwestern Oil & Refining Co.'s 43,000-bbl. refinery here. Basic feed stock will be straightrun naphtha. The unit was constructed by Refinery Engineering Co.

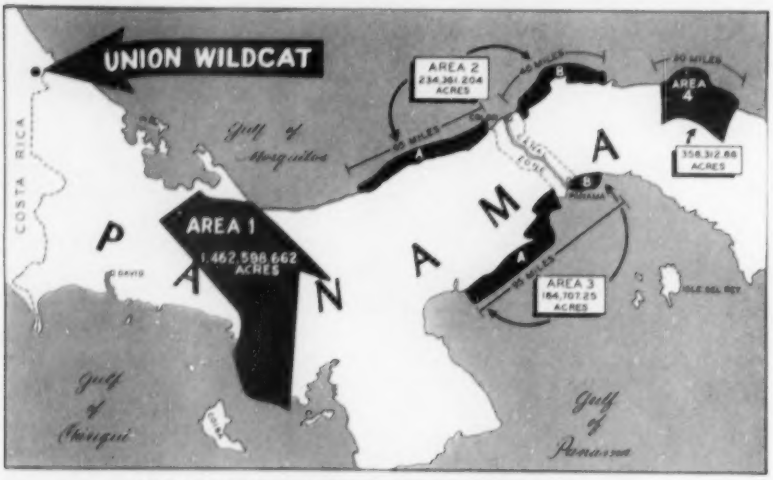
BEAUMONT, Tex.—New expanded portside facilities here will receive tetraethyl lead early next year in the first tanker shipment of that gasoline additive ever made.

Du Pont will initiate bulk shipments by water from its Chambers Works in Deepwater, N. J., to improve its service to refiners in the southwest. Blending facilities and tankage for TEL scavenging agents are being added to the new Gulf Coast center, and shipping facilities will be expanded. This will give Du Pont its third major supply point for TEL in addition to its East Coast plant at Deepwater and its new West Coast plant at Antioch, Calif.

ORANGE, Tex.—E. I. Du Pont de Nemours & Co., Inc., will double the capacity of its polyethylene plant at the Sabine River Works here. Production will be in the field of the conventional intermediate density polyethylene. Du Pont has a process for making higher density linear polyetheylene now in the pilot-plant stage. The company is expected to announce commercial production at a later date.

LAKE CHARLES, La.—Fluor Corp., Ltd., has been awarded a contract to build a 10,000-bbl. per day delayed coking unit for Lake Charles Chemical Corp., subsidiary of Continental Oil Co., at Conoco's 51,000-bbl. refinery here. Lake Charles Chemical, a new company, will own the coker and market its output. Cost of the new unit is about $6,250,000. Construction is due to begin September 1. It will be placed on stream a year later.

BAKERSFIELD.—A 1,500-bbl. Uni-fining and rerun unit will be built at Douglas Oil Co. of California's refinery here. Douglas plans to have the rerun unit completed by late summer. The Unifining unit is scheduled to be in operation before the end of the year.



CONSOLIDATED AMERICAN'S concessions in Panama.

Panama Gets New Play

● U. S. firm, neophyte in oil business, makes plans to drill at least two wells on big concession by next June

PANAMA has granted a 2,240,000-acre concession to Consolidated American Industries, Inc., a diversified company entering the oil industry for the first time.

The acreage consists of six blocks. The largest is a 1,463,000-acre area covering the entire width of the republic about two-thirds of the way from the Canal Zone to the border of Costa Rica, where a Union Oil Co. wildcat promises to be Central America's first commercial producer *(The Oil and Gas Journal, April 16, page 138)*.

The remaining blocks lie along the Caribbean and Pacific coasts. On the Caribbean side, one strip runs for 65 miles southwest of the Canal Zone, while two blocks of 45 miles and 30 miles in length run east of the zone. The Pacific Coast strip is 95 miles long, interrupted by the Canal Zone.

Consolidated American, formerly called Diversified Financial Corp., will start a well about November 1 near San Blas located on the Caribbean Coast, approximately 100 miles east of Colon. Negotiations now are under way to select a drilling contractor. Equipment probably will be brought in either from Cuba or Texas.

The concession agreement is for 20 years. Consolidated American must drill at least two wells by June 1957. The company did not disclose its royalty tax setup with the Panamanian Republic in the event commercial production is found.

The most recent exploration in Panama was abandoned in 1949 after two dry holes. Sinclair Panama Oil Corp., in which Cities Service Co. held a minority interest, had conducted a 3-year exploration program on a 17,700,000-acre concession.

Consolidated American's other holdings are Sanders Manufacturing Co., Tulsa, a producer of ordnance and aircraft components; American Railway Salvage System, Dallas, merchandiser of consumer and industrial goods; Coastal Co., Houston, a discount-house operation; Atlas Insurance Co., an Alabama organization; and Ace Cabinet Corp., maker of refrigerated display cases and cabinets, and laundry dryers.

New Israel Tests Planned

Pan-Israel Oil Co. and Israel-Mediterranean Petroleum Co. will explore a 100,000-acre concession adjacent to the newly discovered Heletz field on a farmout basis.

The acreage is held by Israel Continental Petroleum, Ltd.

Under the arrangement, Pan-Israel and Israel-Mediterranean will drill 10 structure holes which will entitle them to an option to drill a deep test and earn a 50 per cent interest in the acreage block. The structure drilling has been started at Tel El Hasi, 7 miles east of Heletz.

The two companies jointly hold concessions covering about 800,000 acres. They have a deep test in progress 1 mile east of Haifa, and another 6 miles southeast of Heletz *(The Oil and Gas Journal, May 21, page 146)*.

Overlaps Studied

124 conflicts still exist in Guatemala applications

THE 22 companies eligible to receive oil exploration acreage in Guatemala have until July 10 to work out conflicting applications.

If all conflicts—and there were 124 remaining last week—are not settled by then the Guatemalan Government will auction the disputed tracts. Only those companies involved in the dispute will be eligible to bid.

When the government declared 7 of the 29 applying companies are not eligible for acreage it automatically tossed out more than 190 conflicting applications for land. Another five companies were declared only partially eligible. Guatemala's newly formed Bureau of Hydrocarbons said the five were not financially able to develop all the acreage they sought *(The Oil and Gas Journal, June 11, page 103)*.

Adjustment of the five companies' partial eligibility is expected to reduce the 124 existing conflicts still further.

The remaining eligible companies have been negotiating since May 30 to solve the conflicts. The Bureau of Hydrocarbons planned to start holding meetings last week with the companies involved in an effort to resolve all the conflicts before the expiration date.

Two Caracas Firms Set Up

A number of American independents have interests in two Caracas oil companies formed this month in anticipation of new concession grants by the Venezuelan Government.

One company is a subsidiary of a firm incorporated in Nassau, the Bahamas, with capital of $10,000,000. Leon Ross is president. Caracas business men will preside over the subsidiary. Interested American firms include Boger Oil Co., Star Falcon Oil Co., and Dade Petroleum Corp.

The second company is Venezuelan Leaseholds, Inc. Enrique Brandt, a Venezuelan, is president. American, Anglo-Canadian, and European companies have interests.

Trinidad Deal Up in Air

Texaco offer to buy Trinidad Oil has Britons up in arms but government tempted by chance to hike dollar reserves

THE TEXAS CO. offer of $176,400,000 for control of Trinidad Oil Co., Ltd. (formerly Trinidad Leaseholds, Ltd.), last week touched off a political bombshell in Great Britain that is still reverberating.

The offer itself came as a surprise to the international oil industry *(The Oil and Gas Journal, June 11, page 103)*. But even more surprising to observers in the United States was the nationalistic howl raised in Parliament from both major British political parties. There were demands that the government step in to prevent the sale.

Under British law, Harold MacMillan, chancellor of the exchequer, could stop it. Securities registered in Britain may not be transferred outside the sterling area without permission of the government.

Dilemma for Britain . . . MacMillan said last week the whole transaction is still "under consideration."

The Tory administration is admittedly on the spot because of the offer. The prospect of adding more than $176 million to Britain's dollar reserves is undoubtedly extremely attractive to the chancellor of the exchequer. Even the prospect of such a transaction sent sterling up sharply in foreign exchange last week.

On the other hand the Tory government, headed by Prime Minister Anthony Eden, is threatened with major political revolt by opposition Laborites in Parliament if it does approve the sale. Labor members last week were demanding floor debate before any government decision. The opposition party, and some members of Eden's own Conservatives, assailed the offer from the moment it became public.

They objected strongly to an American company taking over any British oil interests. By the end of the week the statements against the sale had become so acrid that Laborites were calling The Texas Co. "the most volatile partner in Aramco (Arabian American Oil Co.) without whose money anti-British propaganda in the Middle East and the Persian Gulf could not be financed."

Texaco officials in this country have made no comment. They have confirmed the fact that a proposal was made. But it was Simon J. Vos, Trinidad chairman, who announced that the offer was for $11.23 a share. Texas Co. officials last week confided that the political furore came as a complete surprise.

Reason for sale . . . Vos, who played a large part in negotiations leading to the Texaco offer on a recent visit to the United States, has insisted publicly that it is in the "best interests" of the British Empire and for its colony of Trinidad.

Vos scoffs at the idea that Britain would be losing a valuable oil asset in the sale of Trinidad. In terms of oil, it is too small to be significant, he says.

"The blunt truth of the matter," Vos says, "is that Trinidad Oil Co. has not the financial resources to maintain its position in an ever-expanding oil world." He added that Texaco's "powerful financial resources would enable it to explore new fields in Trinidad."

In addition to the hurdle of British approval, the sale also would have to have the sanction of the Trinidad Colonial Government, but there were indications last week that this would be forthcoming. Albert Gomes, Trinidad labor minister, said he thought the offer would be beneficial to Trinidad's economy. This was the first comment from a high government source since the offer was made.

Trinidad Oil's charter, dating back to 1913, was written deliberately to safeguard the company's British character. It provides the company will hold its acreage on the Caribbean island colony as long as it is a British company registered in Great Britain or a British colony. Any change in this status would have to be approved by the governor of the colony.

The first announcement of the Texaco offer sent Trinidad stock soaring on the London Stock Exchange. The stock more than doubled in value and was holding strong on the market late last week indicating that investors, at least, feel the sale will go through.

Trinidad holdings . . . The company controls 138,872 acres on the island of Trinidad off the northeast coast of South America. Last year it produced about 24,500 bbl. of oil daily.

Trinidad operates an 80,000-bbl. daily refinery at Pointe-A-Pierre. The company has an equal interest with British Petroleum Co. and Shell Trinidad, Ltd., in Trinidad Northern Areas, Ltd., which drilled the first offshore well in the Trinidad area. The well was brought in as a producer in the Gulf of Paria. Two more are being drilled from the same platform.

Trinidad Oil owns 90 per cent of Regent Refining (Canada), Ltd., which has a 14,000-bbl. daily refinery at Port Credit, Ont., and has recently engaged in fairly large-scale exploration in Alberta.

The company also owns 50 per cent of Regent Oil Co., Ltd., a major petroleum marketer in Great Britain and Ireland. The remaining 50 per cent is owned by Caltex (Standard Oil Co. of California and The Texas Co.). Regent recently announced plans to build a 40,000-bbl. daily refinery in southern England in its first venture into refining in the British Isles.

If Texaco acquires Trinidad, it will own 75 per cent of Regent Oil in England, acquire Canadian interests which could be integrated with those it already has, and gain refining, producing properties, and undeveloped acreage in Trinidad.

Egypt Move Hinted

Action is expected soon on new oil concessions

EGYPT soon may act on applications for concessions on 131,000-sq. miles in the Nile Delta, Sinai Peninsula, and the desert east of the Nile.

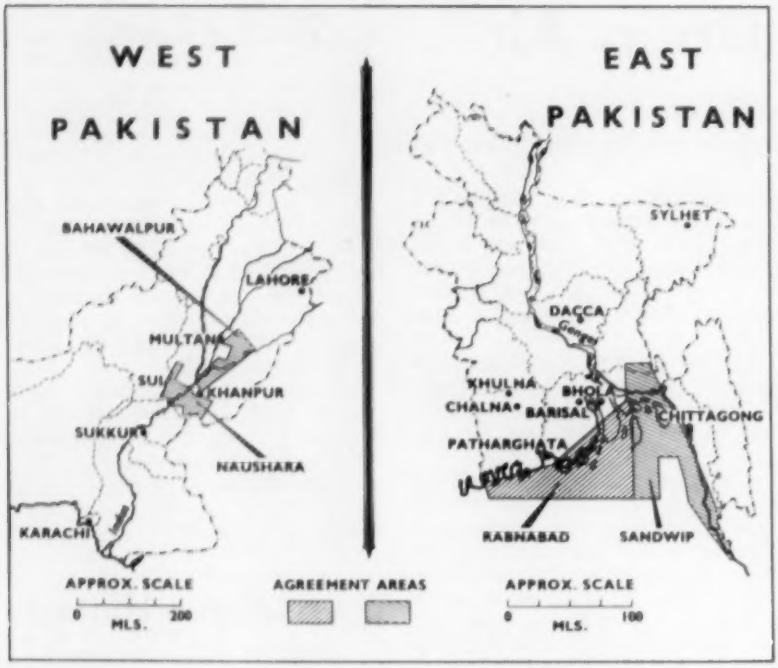
The government has kept silent since bids were opened on April 2 on offers made under new revisions of the mining law. But mention in the Anglo-Egyptian Oilfields, Ltd. annual report that a decision by the minister of commerce and industry is now awaited indicates at least some hope for an early government decision.

Two major companies, Royal Dutch-Shell through Anglo-Egyptian, and Socony Mobil Oil Co., Inc., have made applications for the areas along with a number of independents *(The Oil and Gas Journal May 21, page 144)*.

New licenses for Anglo-Egyptian and Mobil Oil Egypt, formerly Socony-Vacuum Oil Co. of Egypt, also appear to be closer than ever. Anglo-Egyptian has production on the western shore of the Red Sea and has half interest in small Sinai Peninsula output, Mobil Oil owning the other half.

Exploration work by the two companies has been at a standstill because of an 8-year dispute with Egypt, largely over the government's requirement that companies sell products at prices regarded as uneconomic.

The question was regarded as settled early in 1955, but new issues were later injected into the negotiations. These were settled in February and negotiators initialed the agreement. Only final formalities remain before the agreement goes into effect.



Shell Gets Pakistan Tidelands

ALMOST half the exploration area granted last month to a new Pakistan-Shell company lies offshore in the Bay of Bengal along the southern coastal area of East Pakistan.

The new company has two 10,000-sq. mile blocks. One is in the eastern portion of central West Pakistan and the other almost entirely consisting of offshore acreage in East Pakistan. The portion of the West Pakistan block is just east of the prolific Sui gas field being developed by Pakistan Petroleum, Ltd.

The new operating company will be called Pakistan Shell Oil Co., Ltd. It will be owned 75 per cent by Royal Dutch-Shell and 25 per cent by Pakistan capital in the hands of Petroleum Development of Pakistan, Ltd. The agreements were signed in Karachi late in May *(The Oil and Gas Journal, June 4, page 76)*.

Shell officials said last week that the company will begin moving personnel and equipment into the country almost immediately for preliminary work. The company hopes to be ready for its first deep test, to be based on geological work, some time in 1957.

Administrative headquarters for the new company will be set up in Karachi with M. S. Lush acting as chief representative for Shell. Technical manager will be C. MacKay, who carried out the preliminary geological work over the two areas before the concessions were granted.

Wildcat spudded . . . In another development last week, it was announced that Pakistan Petroleum, Ltd., has started its second wildcat in the northeast corner of East Pakistan.

The wildcat, Sylhet 2, is near Chiknagul about 14 miles from the town of Sylhet. The spudding in ceremony followed by a year a well fire at the high-pressure gas discovery which destroyed the rig and camp.

P.P.L. is one of five companies holding concessions in Pakistan *(The Oil and Gas Journal, June 4, page 76)*.

McCarthy Sells Gas

Contract signed to supply Chilean firm from Bolivia

GLENN H. McCARTHY, Houston independent, has signed a contract to furnish 22,000 M.c.f. of gas daily from his Bolivian concession to Anglo-Lautoro Nitrate Corp. of Chile.

Less than a month ago McCarthy agreed to sell Chile Exploration Co., subsidiary of Anaconda Co., up to 30,000 M.c.f. of gas daily *(The Oil and Gas Journal, May 7, page 105)*.

McCarthy said both contracts were signed after an independent engineering study evaluated his Bolivian concession.

Both gas purchase contracts are dependent on the Texan's ability to deliver the gas and both will hence hinge on the success of a pipeline project which McCarthy has under way. He said he is in the process of forming a subsidiary company to be called Andes Pipeline Corp. The new company plans a 500-mile, 12½-in. pipeline from Villamontes, Bolivia, to Uyuni, over a 14,500-ft. pass through the Andes to Chuquicamata, Chile, and then to the port of Antofagasta.

He has estimated the cost of the line at from $30 million to $35 million. McCarthy said it will probably be financed by sale of debentures and stock in Andes Pipeline Corp. He conceded that the two gas contracts will make an accelerated development of the concession necessary, plus "further cooperation from the very helpful Bolivian Government."

Suez Load Studied

Canal seeks oil-traffic trend to plan expansion

A MORE detailed study than ever before undertaken of Middle East oil traffic will be made by the Suez Canal Co. and major oil firms.

The forecast will be made in order to plan future canal expansion when present improvement work is completed.

Jaques Georges-Picot, director general of the canal company said that present forecasts of oil traffic 10 years from now are too varied to serve as a sound basis for planning. Some companies say traffic will double. Others predict it will triple.

A private concern will be employed to make the study.

Meanwhile, Georges-Picot assured oil transporters that the canal can cope with traffic increases in the immediate future. An average of 46 ships per day pass through the canal at present. But 54 ships were taken through for 7 consecutive days recently. On a peak day, the canal accommodated 71 ships.

When two new bypasses are completed in 1957, passage of 10 more vessels daily will be possible.

Japs Get Order for Tankers

Cia. de Petroleo Lago, a subsidiary of Creole Petroleum Corp., has ordered four 32,000-ton tankers from Japanese shipyards. Each vessel will have a capacity of 275,000 bbl., 200,000 bbl. greater than any Creole tanker in operation. The orders closely follow the opening of the new Lake Maracaibo ship channel *(The Oil and Gas Journal, June 4, page 77)*.

British Capital Spurs French Oil Hunt

SEISMIC crews are working on the western edge of the Alps in southeastern France in a venture which marks the first time British capital has been used to hunt oil in France.

A newly formed company, Societe des Petroles de Valence, has obtained exploration licenses in the Isere Department about 100 miles north of Marseilles.

The new company is owned 30 per cent by British Petroleum Co., Ltd., 20 per cent by B.P.'s French associate, Societe Francaise des Petroles BP. The remaining half interest is owned by the state-controlled Bureau des Recherches de Petrole, two private oil investment companies and a regional oil distributing company in France *(The Oil and Gas Journal, February 20, page 103).*

Tatar Output Cut

Russians push pipeline to growing Almetyevsk fields

INSUFFICIENT rail transport capacity has forced Russia to restrict oil production in the Almetyevsk oil fields of the Tatar Autonomous Republic. Output there this year was scheduled to be 65 per cent higher than in 1955.

Soviet reports indicate that restoration of full production in the fast-developing Almetyevsk area depends to a considerable degree on completion of new pipelines to important industrial centers. One line will go north to Molotov; another west to Gorky. At Gorky the line will branch, one link running to Yaroslavl, northeast of Moscow, and the other to Ryazan, southeast of Moscow, thence into the Russian capital.

The entire system will be more than 1,000 miles long.

Construction on the Almetyevsk-Gorky link is already well under way. Pipe has been laid under the Kama River, and work is progressing at the Volga River crossing.

Russia claims that 95 per cent of the excavating work, 75 per cent of the insulation, and 100 per cent of the actual pipe laying on the Almetyevsk-Gorky line is mechanized.

Now . . . turn to the Journal's annual

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Number

Here's the latest in new engineering technology as practiced in this vast oil empire. Staff members and industry specialists bring you 80 pages of material tailored to your interests and needs. Fields covered range from geology to petrochemistry—from gas reserves to water flooding.

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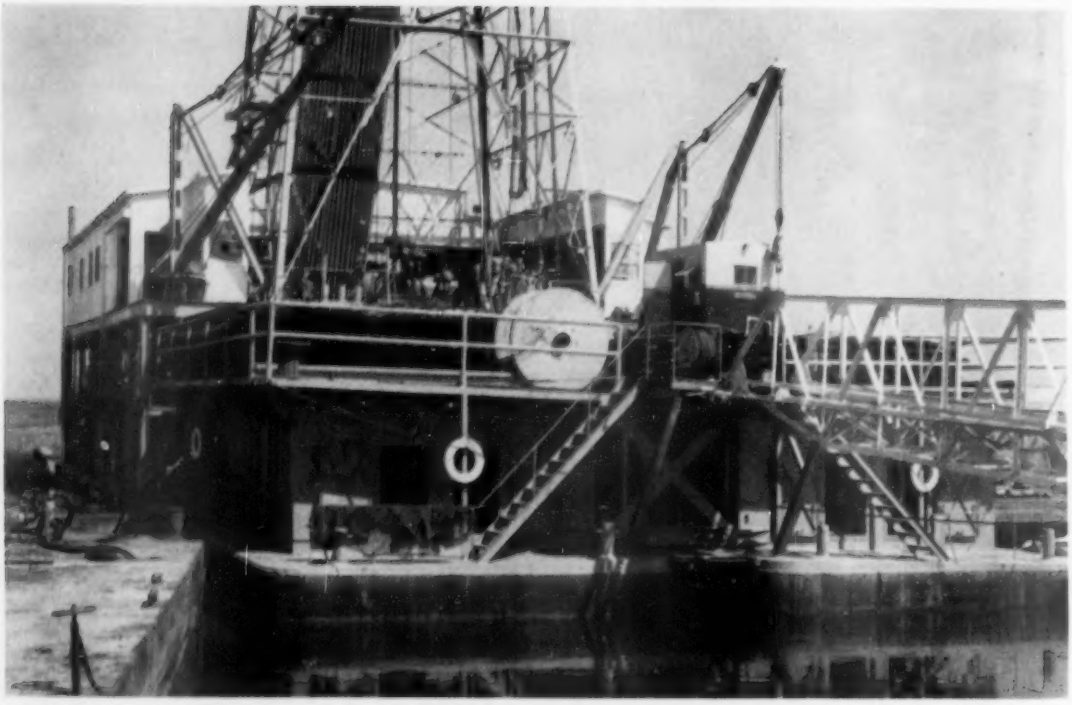

RECORD DEEP WELL went down from this drilling barge of Richardson & Bass. Giving Louisiana the new depth record, the well showed the speed of modern drilling technique by reaching 22,559 ft. in 283 days.

It's a way with Texas and Louisiana drillers to . . .

Drill 'em Ever Faster, Drill

by Ed McGhee
District Editor

DRILLERS in Texas and Louisiana (and they number more than half of all those in the country) apparently believe in drilling ever faster and ever deeper. While drilling speed increases slowly and steadily, drilling depths have been taking big jumps.

Most spectacular deep hole is, of course, the Plaquemines Parish, Louisiana, wildcat of Richardson & Bass. Earlier this year, it reached a total depth of 22,570 ft. and extended the world's record by 1,088 ft. The IL Humble-L.L.&E.-State Lease 2414 was drilled from Richardson & Bass' barge Keystone on a location dredged from salt marsh 35 miles south of New Orleans. It brought the world's depth record to the Texas-Louisiana area for the first time since 1946. That year, the record fell that had been held by a Texas coast well of Phillips Petroleum Co.

In the 14½ months that Richardson & Bass worked on their well, here are some of the records set . . .

. . . **World's deepest well.** It reached 22,570 ft. only 317 days after spudding.

. . . **Deepest casing string.** A string of 5-in. pipe (run in two sections) extends from the surface to 21,809 ft. The upper section of this weighed 26 lb. per ft.—itself a record. The 7-in. casing (also run in two sections) lacks only 13 ft. of equaling a record of 19,765 ft. set in 1949 by a Wyoming well.

. . . **Deepest cement jobs.** One squeeze of 370 sacks was displaced out of the bottom of the 5-in. at 21,809 ft. Temperature at that depth is about 340° F.

. . . **Deepest well logs.** An electric log was successfully run to total depth of 22,570 ft. A gamma ray-neutron log was run to the bottom of the oil string at 21,809 ft. A perforating job from 21,523 to 21,622 ft. is also a record.

. . . **Deepest oil.** The well is completed as an oiler in a zone from 21,419-65 ft. (For more detail on this, see elsewhere in this issue.)

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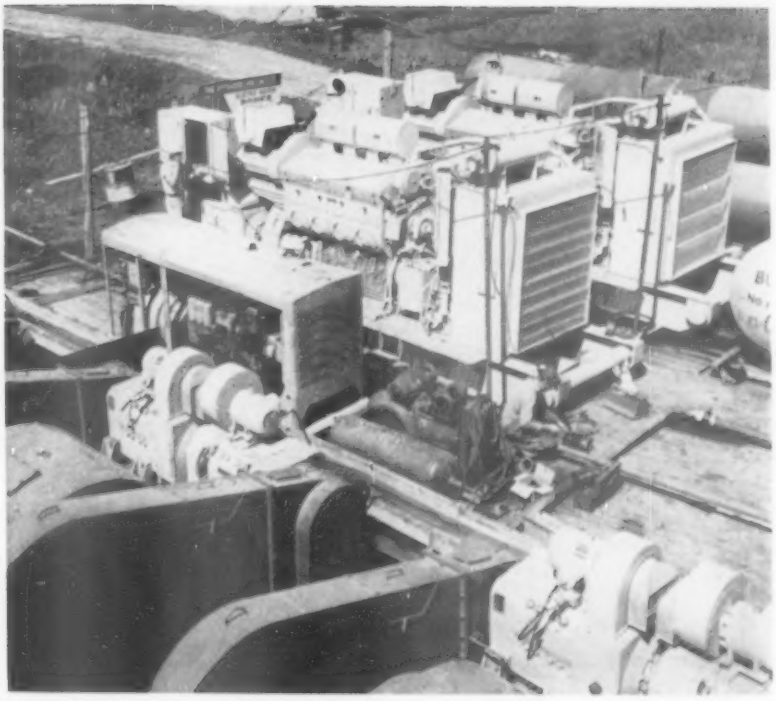
Below 13,655 ft. . . . Drilling of the record-breaking well was routine to 13,655 ft. where an intermediate string of 9⅝-in. casing was set. Below that, Richardson & Bass drilled an 8⅜-in. hole with a string that included 4-in. 14-lb. drill pipe and three 5¾-in. drill collars. Thirty-three bits with 8,000-12,000-lb. weight carried the hole to 19,752 ft.—only 124 days after spudding.

The company set a 7-in. liner to total depth and tested four sands, all of which were dry. To drill the 6-in. hole below the 7-in. liner, a combination string of drill pipe was run. The top 13,000 ft. of it was 4-in. and the remainder was 2⅞-in. 10.4-lb. external-upset drill pipe. Three 4⅛-in. collars put weight on the bit. Richardson & Bass made the next 2,807 ft. (to 22,559 ft.) in 107 days with 36 bits.



DIESEL-DRIVEN GENERATORS operate mostly on Gulf Coast electric rigs while gas-engine drives are favored for West Texas.

'em Ever Deeper

World's deepest well hits 22,570 ft., breaking five all-time records. Electric rigs prove more popular with operators for deep-test drilling.

At this point, the well kicked. After it was killed, the hole was deepened to the final total depth of 22,570 ft. At this depth, a round trip to change bits took more than 9½ hours. To get returns off bottom took at least 7 hours; to get complete circulation, 9½ hours. Pump pressure exceeded 2,800 psi.

Deep and hot . . . Texas also has a new depth record well for the state. This is a deep test in West Ranch field of Jackson County, by Magnolia Petroleum Co. It reached 19,060 ft. before a bad fishing job forced the operator to plug it back. Bottom-hole temperature reached 410° F., the highest ever encountered in a well. Moreover, from 7,500 ft. to total depth, Magnolia drilled solid, sticky shale. This same shale had cost operators many millions of dollars in previous attempts to get through the section. In fact, no well in the area has yet got completely through.

Magnolia was able to drill its deep, hot hole only with the help of a newly developed calcium surfactant mud. Its success in the West Ranch well made Richardson & Bass decide to use the mud during completion operations on their record Louisiana well.

More electric rigs . . . A high proportion of the new deep-well rigs in Texas and Louisiana are diesel-electric or gas-electric drive. While the electric rig is not new, few drilling men were interested in it until recently. But, taking a cue from the railroad industry, the drilling industry is finding it's worth while to learn how to run an electric rig. Basically, the advantages of electric power are the same as steam power—flexibility of operation and equipment placement. However, the electric rig keeps the lower fuel and water consumption advantage of power rigs.

Gulf Coast operators prefer diesel-electric drive; in West Texas, gas-electric gets the nod. Availability and cost of fuel are, of course, the deciding factors.

For its platform in 100 ft. of water off Eugene Island, Louisiana, Phillips Petroleum Co. picked an electric drive. The small area of the platform made flexibility of equipment placement a must. The draw works is supported by a cantilever from the derrick substructure. Two 500-hp. electric motors power it. All other major equipment is placed in permanent locations elsewhere about the platform. Flexible conductors connect the draw works motors to the permanently mounted generators. As a result, the derrick and substructure can easily be skidded from one

MULTIPLE-WELL DERRICK is finding application for offshore drilling where drilling space is expensive. The movable crown block and rotary of this rig provides six different drilling positions with draw works and derrick remaining stationary.

well location on the platform to another.

Sun Oil Co. has just rigged up an electric rig for land operations on the Texas and Louisiana Gulf Coast. The diesel-electric power packages made it possible to unitize equipment onto skid-mounted packages for easier moving and faster rigup.

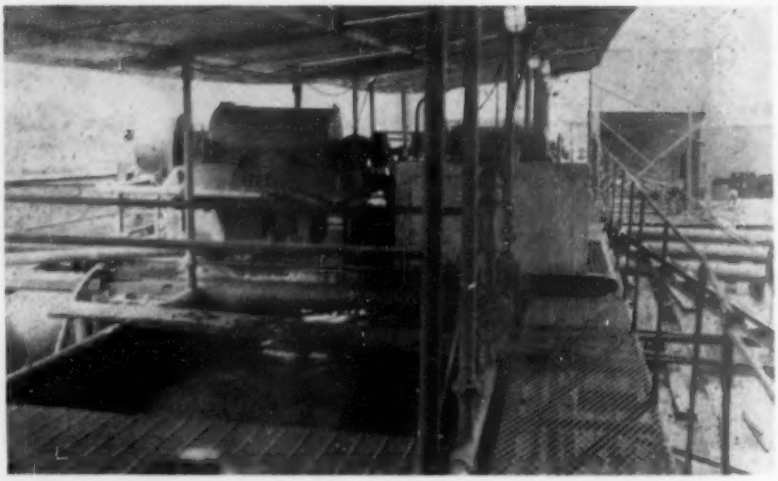
Parker Drilling Co. has put a gas-electric rig to work in West Texas and expects to use it at depths down to 20,000 ft. Drilling & Exploration Co. has a gas-electric rig in Headlee field of the same area. It has set the pace for other type rigs in the field.

Six-place derrick . . . In the 2 years since the first six-well derrick made its appearance offshore from South Louisiana, about a dozen more have been put to work. These derricks are wider than usual at the base and water table so that the rotary and crown block may be moved about. By spotting the crown and rotary, the driller can drill at six different places without changing the position of the draw works, derrick, or other equipment.

Obviously, the application for the six-place derrick is offshore. Platforms are too expensive to set up to drill each well vertically, so several wells must be drilled directionally from each platform.

Of course, the six-well derrick costs more than a regular steel derrick, and moving the crown and rotary takes 6 to 8 hours. At first glance, it would seem cheaper to buy a less-expensive standard derrick and skid it from well to well on the platform. But, the advantage of the six-well derrick is that operations can be carried on at more than one of the wells at once. For instance, the first well is spudded, drilled for a while, and casing set. While cement sets on that string of pipe, the crew can spud a second well with the same rig and set surface casing. Then, when the oil string is set on a well, the driller can move the rotary to another hole. He can drill this third hole while waiting for an acidization or sand-control job on one of the earlier completed wells.

Keeping hole straight . . . More and more contractors in crooked-hole areas of West Texas are using the Woods-Lubinski method for placing stabilizers. These charts (and graphs) tell exactly where a single stabilizer should be placed to get the most benefit while drilling crooked-hole formations.



CUTTING MUD COSTS is a job filled by the centrifuge. Used widely on the Gulf Coast, the centrifuge saves expensive barite and also helps prevent hole trouble by maintaining a low clay-solids content in the mud.

One contractor in that area tells of attending a meeting in Midland where the method of spotting stabilizers was explained. After the meeting, he says he drove directly to one of his rigs which was drilling a bad crooked-hole zone. This contractor spotted a single stabilizer where the charts said it should be. The result, he says, was cutting 22 days off the drilling time.

But, contractors aren't stopping with a single stabilizer. Many are "packing the hole" by putting a stabilizer (or dull reamer) immediately above the bit, another 15 ft. above, and another 30 ft. above. While the packed hole will still gain angle, it will build angle very slowly. The contractors pack the hole just before drilling into a severe crooked-hole formation and put high weight on the bit. If the crooked-hole zone is not too thick, the hole may drill completely through before it builds up to the contract angle.

If the contractor then continues to drill with a packed hole, it will keep gaining angle although slowly. Therefore, when the hole gets close to contract angle, the contractor pulls all stabilizers except one and places that one according to the tables.

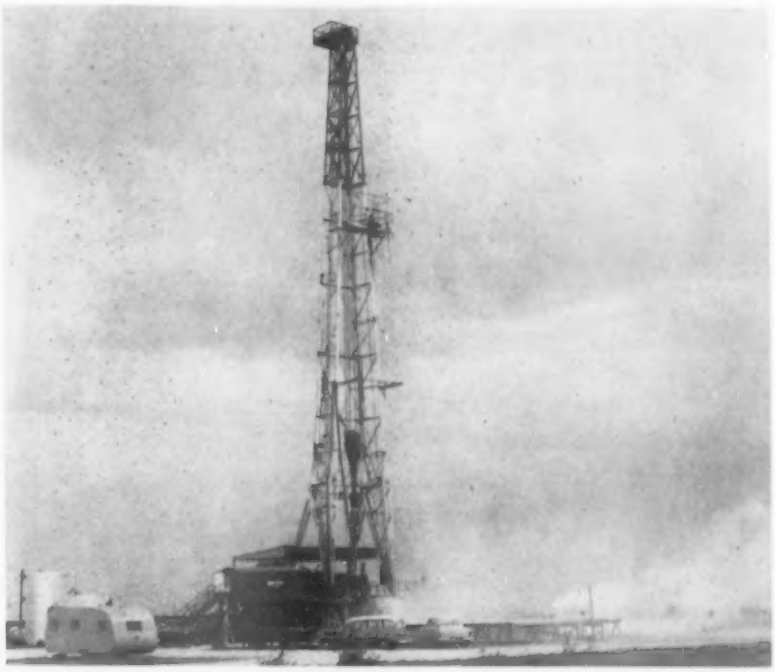
There's another, and equally important, result of the Woods-Lubinski work. It is showing the operators how bad the contractors' problem can be in drilling crooked-hole formations. A few of the operators have seen it is impossible for contractors to drill a straight hole at a profitable rate through some zones. As a result, they have begun to relax their maximum hole-deviation angles. They have relented on demands to whipstock crooked hole—a practice that is extremely costly to the contractor and, ultimately, to the operator.

Centrifuge accepted . . . The Gulf Coast of Texas and Louisiana has always been a mud-problem area. It isn't unusual for mud bills to climb to one-third of total well cost. As a result, operators in this area continuously look for cheaper and better ways to handle mud problems. And the latest tool they have accepted in this search is the decanting-type centrifuge for maintaining a low-solids mud.

There are two basic ideas about operating the centrifuge. Some Gulf Coast operators say that the centrifuge is an added expense and must pay for itself in savings of weighting material. It does save weighting material, but no one can be certain how heavily the mud must be for barite saving to pay for the centrifuge. In some areas with thick deposits of mud-making shale, mud weighing as little as 12 lb. per gallon can show a saving with the centrifuge. In other areas, the centrifuge may not show a payout in barite alone with such a light mud.

Other operators think that the low-solids mud will stop a lot of hole trouble before it starts. Therefore, they say that the centrifuge is a justifiable expense in maintaining low clay solids content. Any saving of barite, while welcome they say, is secondary.

Cyclone separator too . . . The decanting-type centrifuge is bound to get a lot of competition from the cyclone-type separator or desander. This device operates on the principle of the old-fashioned cream separator and can throw out the heavy particles when mud is pumped through it. Originally the separator was used solely to take sand out of the mud while the hole passed through the fast-drilling shallow formations. However, the simplicity (it has



AIR DRILLING is speeding drilling and cutting bits in many areas of Texas. If a method to shut off water were available, air-drilled holes would multiply overnight. Aerated mud can fill the gap where water is a problem, but is more expensive to use than air alone.

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no moving parts) of the desander set operators to thinking about using it to reclaim barites out of a weighted mud.

Several operators on the Gulf Coast tried the idea. They report it worked well. One operator was adding about 300 sacks per day of weighting material to his mud on a Louisiana well. Then, he brought in the cyclone separator and pumped his mud through it for 24 hours. After that, the mud was run through for only a few hours each day. And no weighting material was added to the mud for the remaining 2 weeks the hole drilled after the cyclone started operation.

The cyclone separator is cheaper to buy and maintain that the rotating-type centrifuge, but doesn't give quite so fine a separation.

Operators and contractors in West Texas, too, are interested in the cyclone separator. However, they propose to save the liquid instead of the solids. While drilling the red beds of the Permian basin, mud weight builds up rapidly. As a result, the contractors must continually water back their mud. Then, this fresh water hits the shale section and leaches out the hole.

One contractor has already used the cyclone separator to take out the solids picked up in the red beds. The water saved from the separator was already salty and did not cause much enlargement of the hole in the salt beds.

Air drills on . . . West Texas, North Texas, and Panhandle operators continue to drill some footage with air. Many companies are hunting ways to shut off water zones in these air-drilled holes, but there is little to show for their efforts. If a water-shutoff method does come to light, the number of air-drilled holes will multiply overnight. Contractors like the speed of air drilling and the few bits it uses. Operators like those things, too, as well as the uncontaminated low-pressure pays and the close-to-gage holes.

Milk emulsion . . . Many West Texas contractors regard fresh, clear water as the best drilling fluid for making fast hole. However, many find that bit bearings wear better when there is a small amount of oil emulsified with the water. In past years, there was no emulsifier stable enough against contamination by salt water or anhydrite to be widely used. But recently a non-ionic emulsifier has been put to work that does resist contamination.

This "milk emulsion," as it is called because of its whitish color, has improved wearing qualities of bit bearings. As a result, bit runs are longer and more weight can be carried. Higher bit weights make drilling faster and cheaper.

One of the biggest benefits of the milk emulsion is that cuttings arriving at the surface are larger than when water is used. Most operators agree that the small amount of oil in the emulsion (usually about 5 per cent of diesel oil) does not seem to contaminate samples.

When using the emulsion, pits must be kept clean in order to permit drilled solids enough time to settle out. On some jobs the shale pit is filled as often as twice each tour if the shale shaker is out of service.

Two-section casing . . . On wells where hole trouble can develop if pipe is out of the hole too long, some Gulf Coast operators now run their deep oil strings in two sections. The first section is run on the drill pipe as a liner and cemented through the open hole. Later, the second section is run, attached to the first, and cemented.

Since the drill pipe does not have to be laid down and since the liner section is run on the drill pipe, the open hole is usually cased off before trouble has time to develop.

Permanent-type completion . . . Use of the permanent-type completion in South Louisiana and the Texas Gulf Coast still grows. And, in the future, one of the biggest customers for this through-the-tubing workover will be offshore producers. The cost of barging a workover rig to an offshore platform is terrific. It is so great that only a really prolific zone will be profitable for recompletion. But wire-line tools can do the recompletion work for a fraction of the cost of conventional methods.

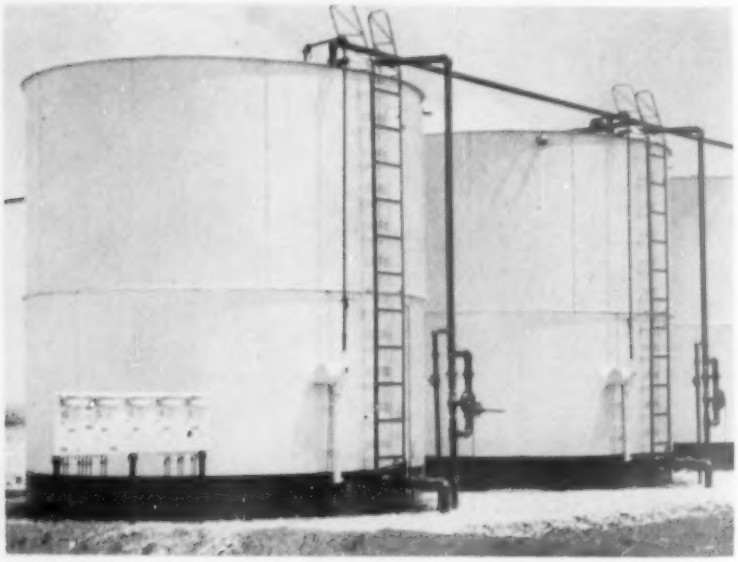
Independent tubing strings . . . New equipment for running two independent, parallel tubing strings is making dual completions more popular. Most important feature of the new equipment is supporting the weight of each tubing string independently; there is no need for clamps or other potential fishing-job causes in the hole.

Moreover, both zones of the dual flow through the inside of tubing, not in an annulus area. This keeps them flowing longer, prevents a lot of corrosion problems, simplifies paraffin removal, and eases the sand problem. Downhole equipment can be chosen so that it is even possible to work over the bottom zone without disturbing the upper one.

One operator in Louisiana has even triple-completed a well using three independent tubing strings and three packers.

DEEPEST PRODUCTION in the world, found with the Richardson & Bass rig, left, has expanded exploratory thinking about deep pay zones. Cores at 21,000 ft. have 18 per cent porosity.

AUTOMATIC SWITCHING of lease tanks is one of the most widely adopted new methods of lease control. Shown below is a pneumatic-type system. Also shown are remote-reading tank gages.



From breaking production depth records, to adopting automation . . .

Texas-Louisiana Sets a Brisk Pace

WITH 50 per cent of the United States' production and 60 per cent of its reserves, Texas and Louisiana should turn up a lot of surprises for other areas. And they are doing the expected.

Probably the most far-reaching new development is the completion of Richardson & Bass' 1L Humble-L.L.&E.-State Lease 2414. This well is flowing 43°-A.P.I.-gravity oil from a Miocene sand at 21,419-65 ft. The well is 35 miles south of New Orleans in Plaquemines Parish.

This well extends the previous producing-depth record more than 3,500-ft. But it has also extended something even more important—exploration thinking. Many competent geologists and engineers had doubted that oil could exist in commercial quantities at such a depth. They believed that porosity and permeability would be mashed out of all formations by the weight of the overburden. Obviously, this is not the actual case. Sand cores taken from about 21,000 ft. on the Richardson & Bass well have a porosity of 18 per cent and permeability of 100 md.

Some still maintain that the overburden will cause a failure within the reservoir rock after a portion of the fluid is withdrawn from it. This remains to be seen.

Simplest hookup . . . When the operator moved the rig off the new-record well in May, it was flowing 206 bbl. of pipeline oil per day through a ¼-in. choke. Gas-oil ratio was 1,400:1 and tubing-head pressure was 1,700 psi. To equip this well, Richardson & Bass engineers picked the simplest possible downhole hookup. Two-inch tubing hangs out of the tree, without a packer, to a point just above the perforations. The reason is that tubing could not be expected to hold the bursting load that could be imposed on it by an abnormal-pressure zone at such a depth. The casing (5-in. 26-lb. per foot) is designed to withstand the bursting pressure.

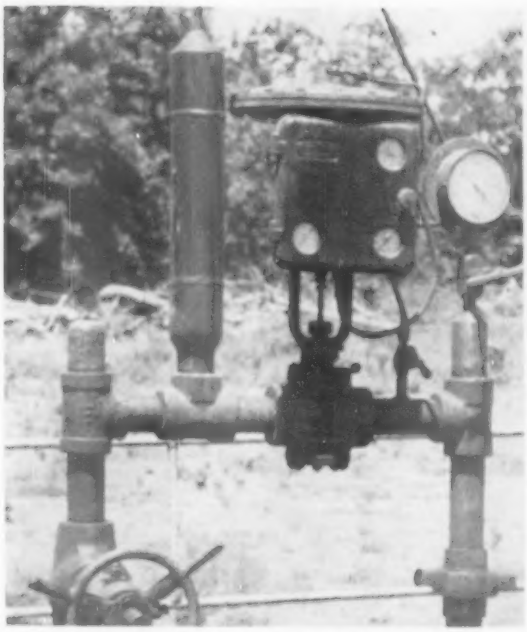
Partners in the venture with Richardson & Bass are Freeport Sulphur Co. and John W. Mecom. The first barrel of oil brought up from the record depth cost them more than $2,500,000.

Next deepest too . . . Besides the Richardson & Bass well, the next few ranking wells for depth of production are also in South Louisiana. They are at Weeks Island field in Iberia Parish. Second deepest and the old record holder is Shell Oil Co.'s 1 C. B. Patout, which produces gas and condensate from 17,558-84 ft. Until this well was completed early in 1956, the producing-depth record swapped between several wells of Shell and Humble Oil & Refining Co. in the same field.

Automatic controls . . . Apparently, one of the things uppermost in the minds of producers in Texas and Louisiana is automatic control. Probably, in the last year more automatic-control equipment has been installed on oil and gas leases than in all previous years combined.

Most widely used single item is the automatic tank switcher. Electrically operated units seem to be most popular, but pneumatically operated and mechanically float-operated types find many applications. Almost always for the electric systems the operators pick pneumatically operated valves triggered by electric pilots. Most of the systems also have tie-ins with the pipeline valve on each tank so that oil can't enter any tank on pipeline run.

Where it is practical, most operators like to have automatic shutdown de-



WELL CONTROLS are important to automatic production control. Shown here is a high-low pressure controller on a flowing well. A flow-line break or shutoff shuts the well in.

TIMERS AND RECORDERS are increasing well-producing efficiency. In this installation, test production is recorded by registers and the pumper can see exactly where a well is pumping off and adjust the sequence timer accordingly.

for Domestic Producers

by Ed McGhee
District Editor

vices tied in with tank switchers. That is, when all tanks are full, the wells are automatically shut in. Very often, this takes a roundabout course from tank to well. Generally, when all tanks are full, the tank inlet valves close. As a result of this, the separators and heater-treaters begin to fill up. When their fluid gets to a high level, their inlet valves also automatically close, backing up the fluid and pressure in the flow lines.

At the wellheads, there are several ways to shut in production when the flow line is shut at the lease battery. On flowing wells, a high-low pressure shutdown can do the job. On electrically beam-pumped wells, the pressure buildup can be used to shut off power to the pumping motor. On gas-engine-operated beam pumps, the pressure buildup can open a valve between casing wing and tubing wing so that all fluid pumped recirculates back into the well.

Automatic sequence timers for electrically beam-pumped wells are becoming so common they are no longer thought of as "automation." Nevertheless, they offer savings in power costs and wear on equipment. One of the biggest helps in making these timers effective are the new automatic well testing setups. Since most of these arrangements record each barrel of fluid as it is produced, it is no problem for the pumper to see exactly where his well is pumping off. He then can cut it back to keep it from pumping off and "pounding fluid."

Perhaps even more important, automatic well testing insures accurate, prompt information about each well. While good well tests can't be tagged in dollars and cents, field personnel or reservoir engineers don't doubt their value.

Of course, the best time to put in automatic-control equipment at a lease battery is when that battery is built. But, no operator can be sure of his future production when he first begins to drill his lease. So, it's seldom practical to start out a new battery completely automatic. But when equipment must be replaced because of corrosion failure, unitization of the field, etc., there is the best chance to make the automatic equipment pay its way. First, automatic batteries seldom need as much tankage; each tank tops itself out as it fills. There is no need ever to have two or more tanks in the same battery waiting to be topped out. Next, labor needs can be held down. It's very seldom that operators may cut down their labor force by installing automatic equipment; but, often, they can prevent having to hire more pumpers.

Remote-reading and ground-level gages are proving important time savers. With the remote equipment, the switcher can sit in one place in the field, and gage every tank in that field. If transportation about the field is a big item, the remote gages can pay out quickly. In several places, the operators have installed monitoring systems along with the remote gages. The monitors flash warning to the central control point when there is trouble at the batteries or wells. Some of the operations that the monitor can watch are the heater-treaters and beam pumps.

Automatic transfer . . . Although there are leases (notably Shell's in Wasson field) capable of automatic custody transfer, none in Texas or Louisiana is actually selling crude automatically.

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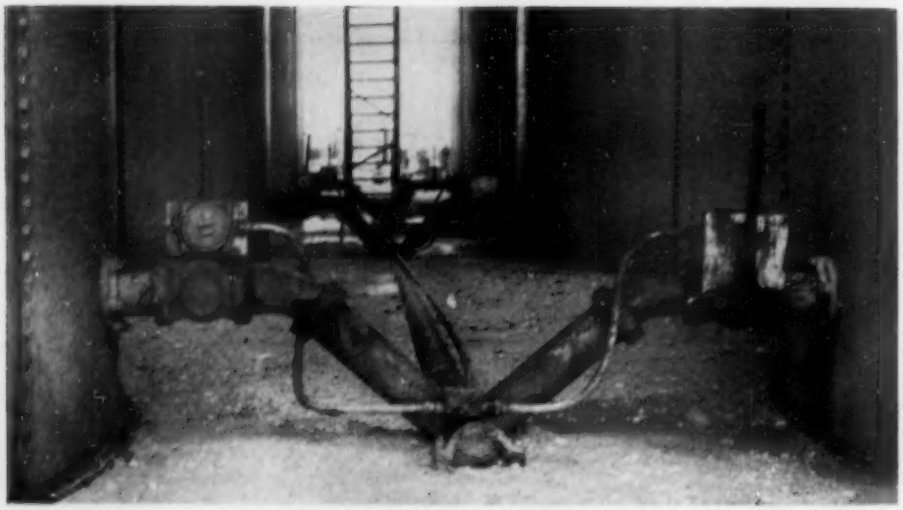
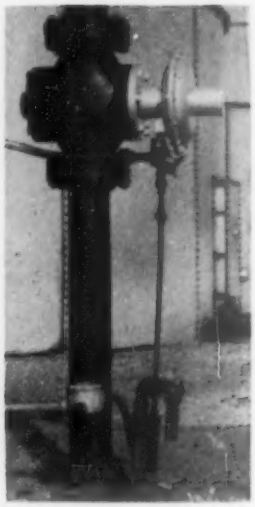
NEW ENGINEERING TECHNOLOGY



TANK CONTROLS save labor and reduce crude losses. The electric controls above are on the pipeline valves. When a tank is discharging, they lock the fill valves (right) automatically.



FILL VALVE is pneumatic with electric pilot.

The Texas Co. is now installing equipment to do this from a platform in West Cote Blanche, Louisiana, field. The wells in this field produce into tanks set on the platform. During bad weather, it is difficult to reach the platform. And boat transportation is expensive in any weather. Therefore, The Texas Co. stands to make a big saving by automatic selling.

In this installation, the oil will be measured out to a weir tank. Each filling to the top weir and later pumping out to the bottom weir will mean a definite number of barrels of oil sent to pipelines. The percentage b.s. and w. will be measured by hand in the usual way from samples collected automatically from each run. Temperature and gravity will be taken by automatic recording instruments.

There will be, however, a device to detect when b.s. and w. content is too high. When this happens, the device will reroute the oil through a heater-treater set on the platform.

For several months after all equipment is operating in West Cote Blanche, the runs will be checked manually by conventional measurements. When The Texas Co. and the Louisiana Conservation Commission are satisfied with the equipment's accuracy, sale of crude will become completely automatic.

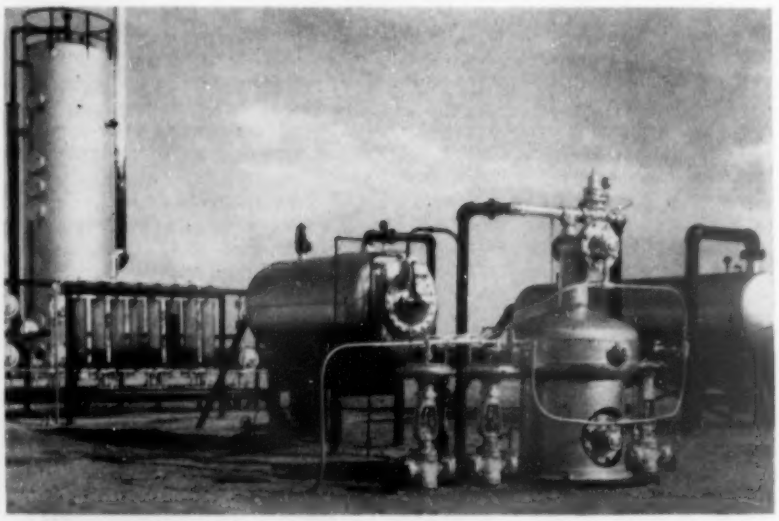
Other companies say unofficially that they intend to start automatic sale of oil with meters. Here again, measurement of b.s. and w. content will be done by hand from automatically collected samples. Shell Oil is reported ready to install a microwave link at Wasson to bring data from automatic batteries into a central office. A single-channel link will send data on volume, temperature, cut, and gravity of oil run. This will be automatically transferred to punch cards at the receiving end.

Getting "attic" oil . . . Louisiana is the scene of two very important experiments in recovering attic oil. In both cases, oil companies were faced with losing oil updip from existing wells. The fields have active water drives that prevent gas-cap or solution-gas expansion from driving the updip oil down into the producing wells. Drilling new wells updip is expensive. Moreover, the operator has a near-impossible job to spot them where they will get all (or even a big part) of the attic oil.

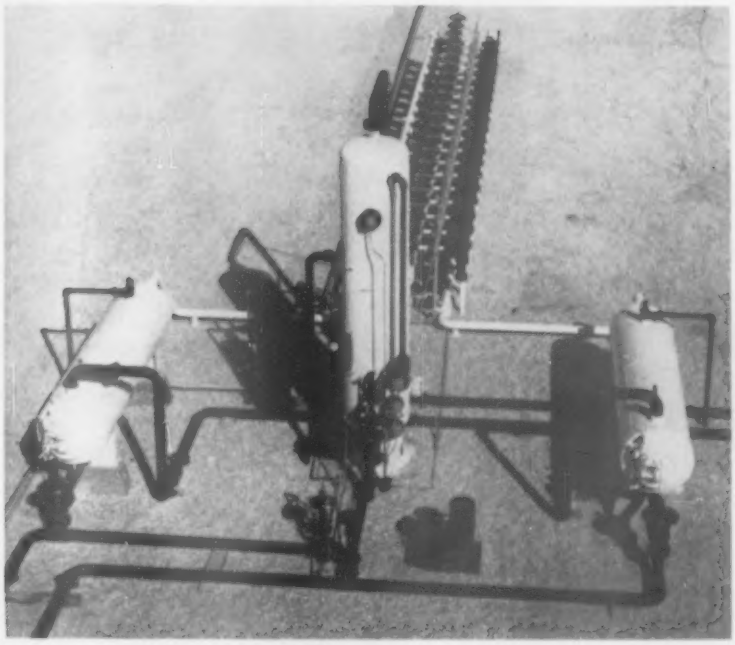
For those reasons, the companies decided to inject gas into downdip wells. The idea was that gas should travel upstructure—up into the attic. Then, if permeability is good enough, the oil there should be displaced smoothly and quickly downstructure where it can be produced through existing wells.

In the first field trial, Stanolind Oil & Gas Co.'s West Hackberry field in Cameron Parish, the idea has worked well.[1] In the second, Humble Oil & Refining Co.'s Block 18, Grand Isle, operations have not gone on long enough for results to be complete.[2]

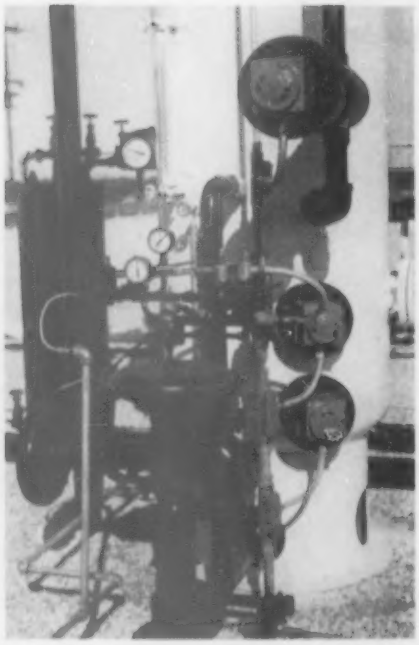
The Stanolind project is in a salt-dome reservoir where an active water drive brought a high recovery of downdip oil. But that same water drive made it economically impossible to drain the upstructure oil with conventional means. New upstructure wells



AUTOMATIC WELL TESTING promotes more efficient lease operation. Here, a timer automatically sequences production from each of eight wells into the test separator. The dump meter records production and chambers receive a sample.



AUTOMATIC CUSTODY TRANSFER may soon begin in Texas and Louisiana at leases equipped like this one. One of the horizontal separators handles clean oil while the other takes oil with a high water cut. In the center is the . . .



. . . METERING SEPARATOR with closeoff valves and float switches. This tank combines separation with positive fluid measurement in 2-bbl. increments.

would cost as much or more than the extra oil would be worth; and new wells would be hard to spot for best drainage. Therefore, Stanolind began injecting gas into a former producer downdip. Permeability of the producing sand is 1,300 md.

After the well had taken gas for a time, it was backflowed to see how effective gravity segregation was. The well made oil with little gas, proving that the gas was, indeed, moving rapidly updip.

For the next 5 years, production tests of the injection well continued to show there was no gas phase down to that level. Every backflow test made oil with a low gas-oil ratio. Then, in 1955, a backflow test for the first time showed that the artificially created gas cap extended down as far as the injection well. During the previous 5 years, 3,150 M.M.c.f. of gas had been injected into the reservoir and 1,000,000 bbl. of oil had been produced from it. The water level in the reservoir had stopped its advance and the danger of premature flooding out of downdip wells had been stopped.

One-well reservoir . . . The reservoir at Humble's Block 18, Grand Isle, is small and has only one well producing from it. Unfortunately, this well is located at the oil-water contact. Water drive is strong and, at the time of first gas injection, the single well was already producing 75 per cent water. Since the field is offshore, locating a new well upstructure would come at a high cost—perhaps even more than the value of all recoverable updip oil.

Therefore, Humble has decided to inject gas into the single well, expecting it to travel updip. The attic oil, as it is displaced downward, should displace the water at the level of the injection well. After a precalculated amount of gas has been put into the formation, injection will stop and the injection well will be backflowed.

In relatively steeply dipping formations of moderate thickness and high permeability it should be possible to inject gas and produce oil at the same time in the same formation.

Help for deep pumpers . . . In the past 2 years, operators in West Texas and the Gulf Coast have been watching performance of rod-weight compensators for pumping deep wells. Thus far, almost all experience has been good. These devices transfer a part of the load from the rod string to the tubing string. As a result, the rod-weight compensators let the operator set his pump lower than he could otherwise. Or else, the compensators make it possible to use a larger pump at the same depth.

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Almost always, after a rod-weight compensator is installed in a deep pumper, the number of rod breaks goes down. Very often, the compensator has paid for itself in only a few months by cutting down on the number of pulling jobs to replace broken rods.

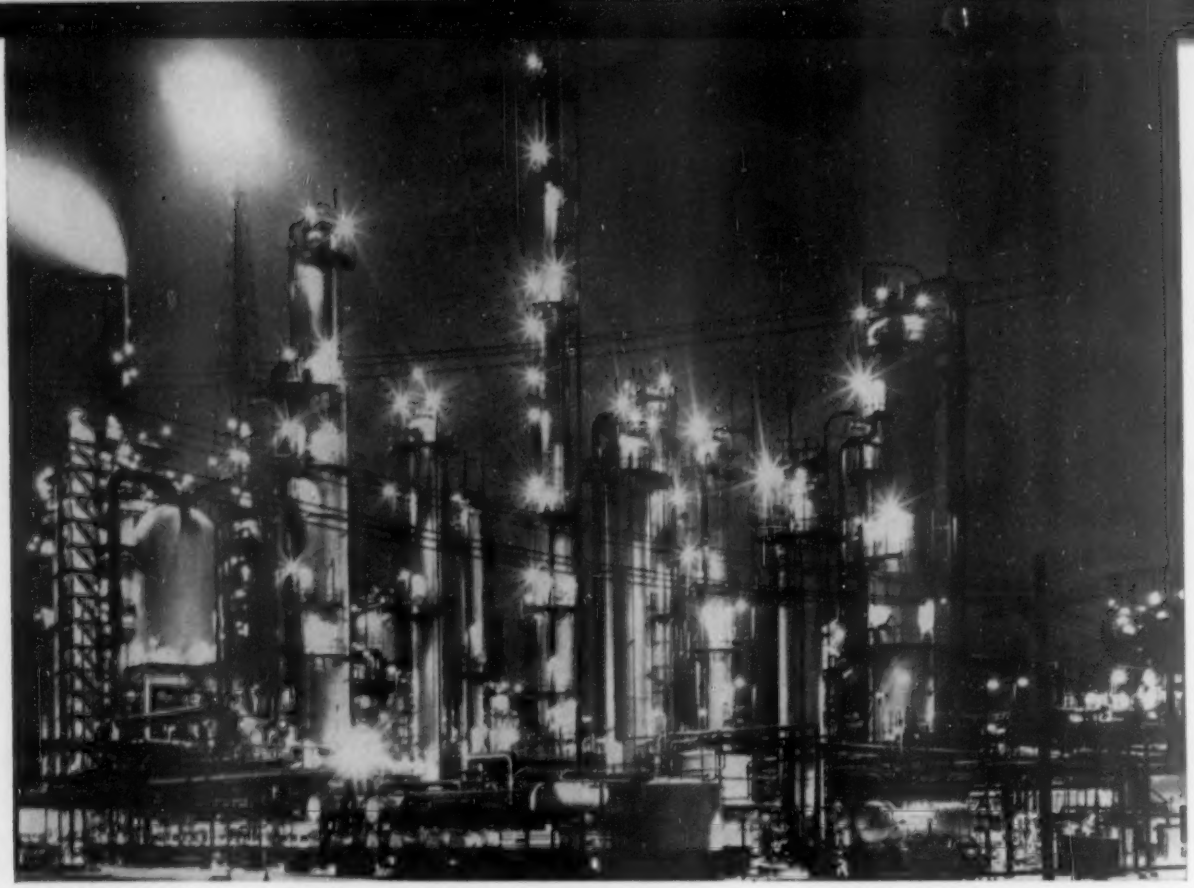
Plastic coating jumps . . . Texas and Louisiana are becoming big customers for plastic-coated tubing and line pipe. There is enough backlog of field experience to prove that coated pipe will resist corrosion and won't collect paraffin so badly. And a lot of the newly coated pipe is going into ordinary wells where corrosion or paraffin deposition is a problem.

The things that account for a big jump in use of plastic-coated pipe are not ordinary wells, but dual completions and offshore wells.

Offshore flow lines are a problem, too. They are under water and the oil is always chilled when it hits the flow line. If the oil tends to deposit paraffin, this chilling makes the tendency even worse. Steaming flowlines to remove paraffin is difficult or impossible offshore. Therefore, plastic coating which keeps the paraffin entrained with the oil can save money.

References

1. R. M. Morrow: "Updip Oil Recovery by Downdip Gas Injection," a paper presented at T.P.R.C. meeting, Texas A. & M. College, April 9, 1956.
2. The Oil and Gas Journal, August 15, 1955, page 99.



NEW FLUID CATALYTIC CRACKING UNIT at Gulf Oil Corp.'s Port Arthur, Tex., plant processes 68,500 bbl. daily of charge stock into high-octane fuels.

Now that they've caught up on capacity expansion . . .

Texas-Louisiana Refiners Turn

by Larry Resen
District Editor

QUALITY expansion . . . That's the way to describe refining activities in Texas-Louisiana this past year and in the months and years to come.

The dramatic appeal of the mammoth crude-capacity expansions of previous years has been quietly superseded by the number and volume of downstream facilities specifically installed for upgrading gasoline products.

Thus, while over-all crude throughput capacity has increased a modest 5.9 per cent in the past 12 months, cat cracking, cat reforming, hydrogenation, and alkylation facilities have recorded percentage gains of 13.5, 33.6, 75.0, and 9.0, respectively. On a barrel per stream day basis, crude capacity of the two states is 3,203,920; cracking capacity, 1,348,400; reforming, 386,862; hydrogenation, 168,000; and alkylation, 125,373. Compared with total United States capacities, these breakdown to 35.8 per cent, 36.4 per cent, 41.7 per cent, 30.0 per cent, and 49.3 per cent, respectively.

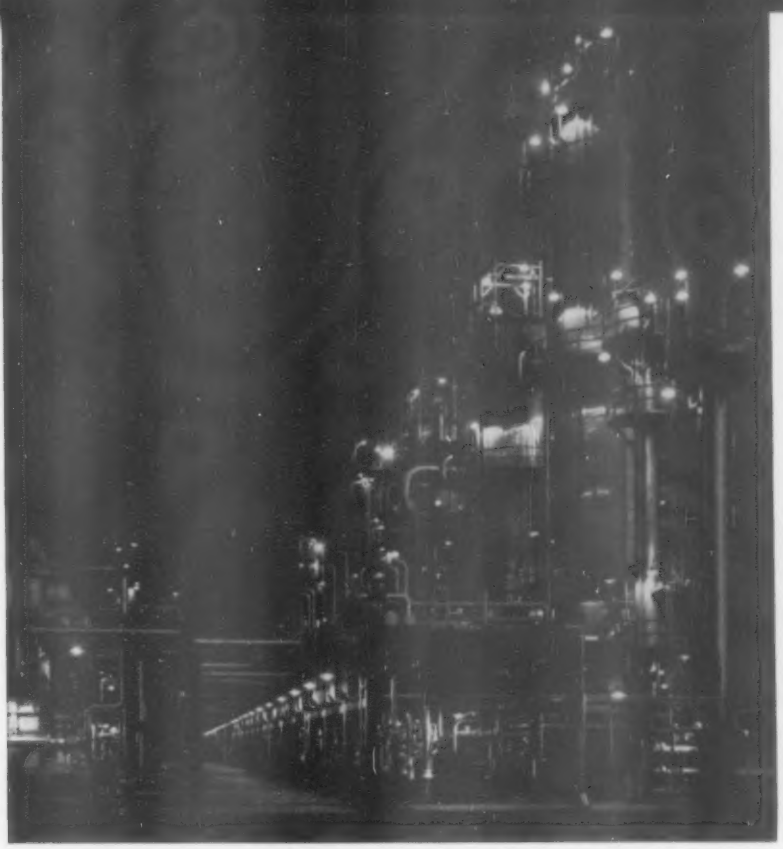
The latest motor-gasoline octane survey points up the need for the heavy emphasis on these diversified units in the production of high-octane motor fuel. Gulf Coast premium sampled in three cities was reported at an average octane number of 97.1, up 0.5 from last year's sampling. On the East Coast, where much of the Gulf Coast output is marketed, premium averaged 96.8 in three cities, also up 0.5 from a year ago.

With this trend continuing, Texas-Louisiana refiners anticipate greater demands on processing facilities for higher and higher-quality products. The recent introduction of a third-grade gasoline by the Esso family with an octane rating "above 100" means the pressure will continue and not abate. Construction projects reported under way in the area list 160,500 bbl. of crude capacity, 59,800 bbl. of catalytic cracking facilities, 90,500 bbl. of catalytic reformers, 98,500 bbl. of hydrogenation units, 11,200 bbl. of alkylation facilities, and 17,975 bbl. of miscellaneous process units. This does not include several major products for which figures are not immediately available, such as a cat cracker at The Texas Co. and Esso's multimillion-dollar Baton Rouge expansion.

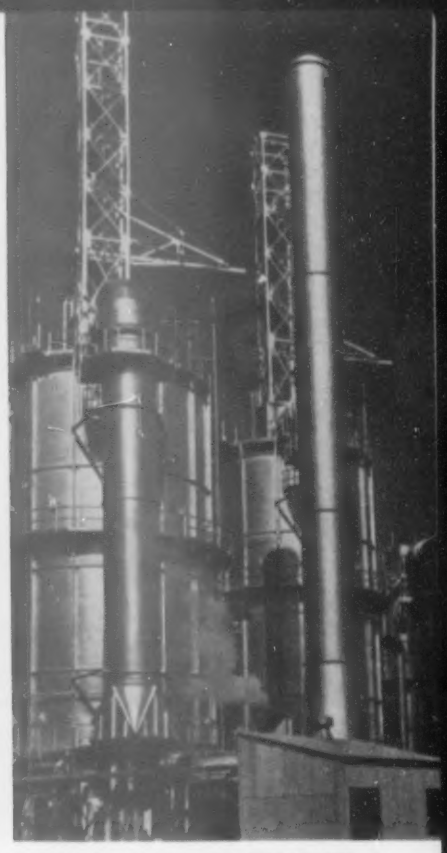
A great portion of the crude capacity will be used to retire older, less-efficient units rather than contribute to a net increase in over-all plant throughput.

Who's expanding . . . Its hard to pick out a refiner who hasn't expanded within the last year or who isn't in the process of adding units. A rundown on various projects will emphasize this point.

Esso Standard Oil Co. at Baton Rouge has probably the most ambitious program. It recently announced a 2-year, 40-million-dollar expansion program at the mammoth refinery, already the largest in the United States. Part of this expansion will be in the form of an ethylene plant which will feed raw materials to new petroleum facilities in the locality. Twelve million dollars has been earmarked for this latter unit. Esso also set what is believed



TWO 20,000-BBL. PLATFORMERS are used at The Texas Co.'s Port Arthur, Tex., plant for upgrading products.



24,000-BBL. CATALYTIC REFORMER at Sinclair's Houston plant.

Attention to Upgrading Gasoline Products

to be a new United States processing record earlier this year when 321,158 bbl. of crude was charged in a single day. Daily averages for 1 month also reached a new plant high (and probably United States) this year when 300,919 bbl. was charged daily in January.

In the New Orleans area, Bay Petroleum Corp., recently acquired by Tennessee Gas Transmission Co., has a general expansion under way which will add 4,000 bbl. crude capacity and increase vacuum and visbreaker capacities by 1,600 bbl. each. In addition, a 12,000-bbl. fluid catalytic cracker is being built plus a 5,000-bbl. Platformer. Ingram Oil & Refining Co. is also adding crude and vacuum capacity—2,000 bbl. and 1,000 bbl., respectively—and building a 3,000-bbl. Platformer. Shell Oil Co., upriver at Norco, has a minor addition under way in a 4,000-bbl. thermal reformer. Shell recently expanded and modernized its plant there to its present 82,000-bbl. size.

At Lake Charles, Continental Oil Co. pulled an interesting switch. A coker is to be constructed at the 51,000-bbl. per day refinery. However, while this unit will be operated as an integral part of the refinery, it will be owned by Lake Charles Chemical Co. The $6,250,000 coking unit will produce 4,200 bbl. of gas oil daily and 85,000 tons of coke annually. Continental is also adding 7,000 bbl. per day to its Thermofor catalytic cracking capacity, now rated at 24,000 bbl. per stream day.

Port Arthur . . . Jumping over the state line into southeastern Texas, we find the heaviest concentration of expansion in the Port Arthur-Beaumont area. The five major refineries there all have major projects under way.

Gulf Oil Corp. has been in the process of winding up and starting projects this spring at its 272,000-bbl. Port Arthur plant. A 100,000-bbl. two-stage crude-distillation unit was placed on stream, as was a 68,500-bbl. fluid catalytic cracker. Current construction includes a 40,000-bbl. Gulfining unit, doubling polymerization-unit facilities to 5,000 bbl. per day, doubling the sulfur-recovery plant from 60 to 120 tons per day, increasing alkylation capacity by 2,800 bbl., and installing a new packaging and grease plant. Less than a year ago Gulf placed a 29,000-bbl. Platformer on stream and completed it second ethylene plant.

Total output of ethylene is now 1 million pounds per day and with increasing demand for this petrochemical raw material, its anticipated that Gulf will soon add a third plant here.

This refinery, incidentally, is a prime example of quality expansion. Going back a bit, Gulf embarked on a major-expansion program 5 years ago which included the above units plus an additional fluid unit with a 63,500-bbl. capacity and the original 60-ton sulfur-recovery plant. Combined throughput of the crude unit and two cat crackers and Platformer totals 261,000 bbl., almost equal to present crude-charge ca-

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NEW ENGINEERING TECHNOLOGY

SUPERVISORY PERSONNEL at the Houston plant of Sinclair get checked out on the new catalytic reformer.

pacity. However, during this 5-year period, plant crude throughput capacity increased only 10 per cent, or roughly 25,000-30,000 bbl.

Nearby, The Texas Co. has a significant expansion under way. An 80,000-bbl. crude unit is under construction and a new fluid cracker is planned. Some of the new crude capacity will be for expansion while most will be used for replacing older stills. Texaco has also had a continuing quality-expansion program the past few years and has 40,000 bbl. in Platforming capacity and 40,000 bbl. in Unifining capacity in relatively new units.

Also in Port Arthur, Atlantic Refining Co. is building a 13,500-bbl. Catformer and a 13,500 bbl. Unifiner. In nearby Nederland, Pure Oil Co. is building a 15,000-bbl. Ultraformer and a 20,000-bbl. hydrodesulfurization unit.

In Beaumont, meanwhile, Magnolia Petroleum Co. has expansion under way which will stretch into late 1957. Crude capacity will be upped by 15,000 bbl., a new T.C.C. unit of 35,800-bbl. capacity, a 25,000-bbl. Sovaforming unit, a 30,000-bbl. Sovafining unit, and a 8,000-bbl. HF alkylation unit are all in the cards.

Houston . . . In the Houston-Texas City area the story is the same, with expansion continuing although not at quite the vigorous pace as Port Arthur. Republic Oil Refining Co. at Texas City is adding a 20,000-bbl. crude unit to its 45,000-bbl. plant. Again, only part of this will be reflected in new plant capacity. American Oil Co. (formerly Pan American Refining Co.), which has undergone an extensive expansion program in recent years, is building a 5,000-bbl. hydrodesulfurization unit at its 160,000-bbl. plant.

Sinclair Refining Co., at Houston, wrapped up work on a new reformer this spring. The Sinclair-Baker unit has a 24,000-bbl. per day capacity. A brand-new asphalt plant is being built at Pasadena, near Houston, and is due on stream this summer. Its Texas Asphalt & Refining Co.'s 2,500-bbl. plant. Shell Oil Co., meanwhile, wrapped up a second Platformer and added a hydrodesulfurization unit. Both are rated at 16,000 bbl.

At Baytown, Humble Oil & Refining Co. placed several units on stream this past year. A 20,000-bbl. Ultraformer was installed and a 20,000-bbl. fixed-bed Hydroformer was converted into an Ultraformer. In addition, a 12,000-bbl. Hydrofiner for processing cracked naphthas and a 4,850-bbl. one for handling lubes were placed on stream. Present construction includes expansion and modernization of alkylation facilities to increase production by 2,700 bbl.

Not too far from Houston, at Sweeny, Phillips Petroleum Co. continues a major expansion including an ethylene plant which will supply synthesis gas for Houston area petrochemical installations. Phillips is also upping plant crude capacity by 10,000 bbl. to a new high of 81,000 bbl. daily. A large natural-gas-liquids separating and recovery system is being installed there to process liquids arriving from West Texas through the company's pipeline system. This unit will provide feed stocks for the ethylene plant.

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In Corpus Christi, where the bulk of independent refinery capacity is concentrated, activity is also under way with the emphasis on quality. Suntide Refining Co. is increasing plant capacity to 65,000 bbl. per day, making it the largest independent in the country. Additionally, product quality will be improved by a 15,000-bbl. Rexformer to be built which will be followed up with a Udex extraction unit. Suntide is also increasing vacuum unit capacity by 3,000 bbl., cat cracking capacity by 5,000 bbl. and alkylation capacity by 500 bbl.

Southwestern Oil & Refining Co. is building a 9,000-bbl. Platformer at Corpur Christi, while the nearby Pontiac Refining Corp. is adding a 5,000-bbl. Platformer and increasing crude capacity by 5,000 bbl. When current projects are completed, the five independent refiners there will have a combined throughput of 277,500 bbl. per stream day. Sinclair Refining Co.'s 29,000-bbl. plant added to this will put the area over the 300,000-bbl. mark for the first time.

In West Texas, the big news was W. R. Grace & Co.'s buying out Cosden Petroleum Co. at Big Spring. Cosden has a 3,900-bbl. Rexformer and 1,600-bbl. Unifiner under way at its 28,500-bbl. plant in addition to petrochemical expansions. In El Paso, another purchase took place wherein El Paso Natural Gas Products Co. (subsidiary of El Paso Natural Gas Co.) acquired the 3,200-bbl. McNutt Oil & Refining Co., Inc., refinery there, plus out-of-state properties. Standard Oil Co. of Texas, meanwhile, revealed a $25-million-dollar expansion program at its El Paso refinery. Crude throughput will be upped from 38,000 to 61,000 bbl., a new cat cracker and polymerization unit will be included in the expansion.

In three scattered spots in Texas and Louisiana, gas-processing plants backed into refinery processing with installation of catalytic reforming units for upgrading naphthas from field distillates. At Winnie, Tex., Texas Gas Corp. placed a 2,500-bbl. Platformer on stream, while at Carthage, Arkansas Fuel Oil Corp. installed a 900-bbl. unit at its Panola gasoline plant. Southwest Gas Producing Co., Inc., meanwhile, added a 2,000-bbl. Platformer at its Dubach, La., plant. Atlas Processing Co., Shreveport, which pioneered use of reformers in this service, added a 3,500-bbl. Platformer to supplement the 4,400-bbl. unit already there.

RUBBER-PRODUCING FACILITIES of Goodrich-Gulf Chemicals, Inc., at Port Neches, Tex. The plant, bought from the Government in April 1955, makes Ameripol rubber.

First it was ammonia, then polyethylene, which led in petrochemicals . . . now . . .

Butadiene, Synthetic Rubber Pace Expansion

and hub of the activity centers in Louisiana and Texas

● Four new plants will raise annual production capacity of butadiene 343,000 short tons and add 232,000 long tons to yearly synthetic-rubber production capacity.

by Larry Resen
District Editor

A WHILE back it was ammonia, last year, polyethylene—today its butadiene-synthetic rubber which is setting a dizzy expansion pace on the petrochemical bandwagon. Thus, the petrochemical industry continues its tremendous growth pattern. And industry attention continues to be focused on Texas-Louisiana where the bulk of the industry is located.

In this two-state area are located 83.5 per cent of the nation's butadiene capacity, 71.5 per cent of the G.R.-S. copolymer capacity and 100 per cent of the butyl-rubber capacity. And it's here where the expansion is pushing this segment of the industry to record highs.

Synthetic-Rubber Growth

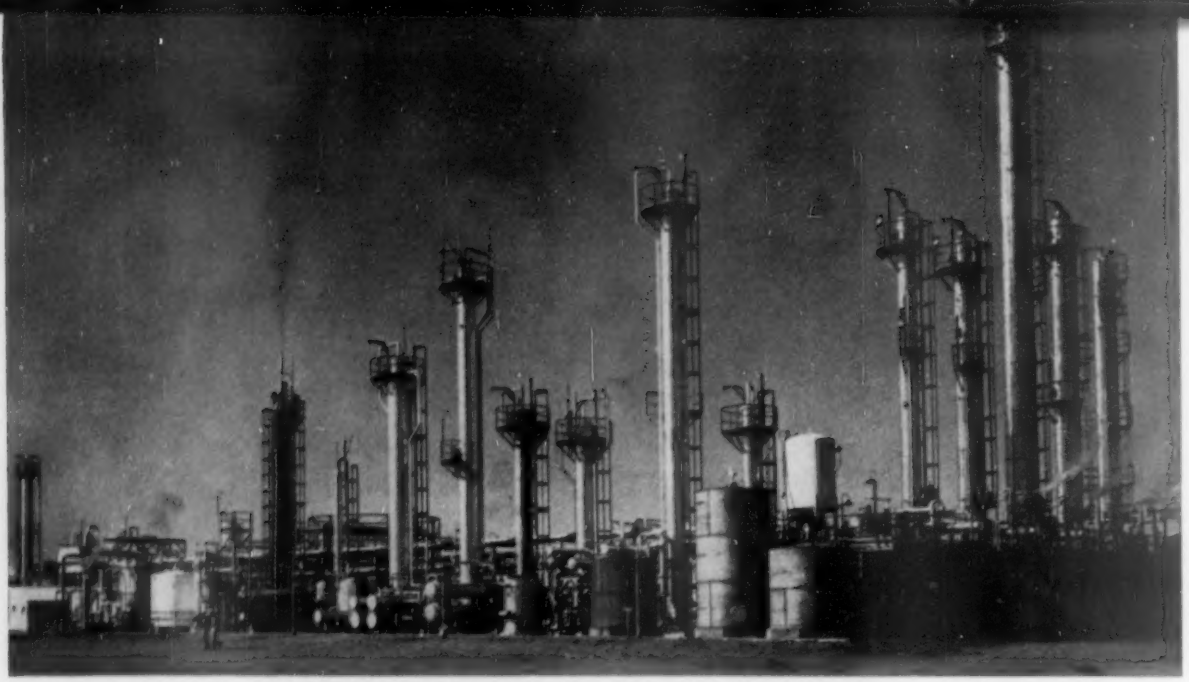
It's difficult to separate butadiene from synthetic rubber when talking about this phase of petrochemicals. The one goes largely to feed the other and hence they're both experiencing rapid growth. After the war many plants were idled and put in mothballs. Reactivation was sporadic, but with the Government selling to private industry, expansion has skyrocketed.

Current expansion plans in Texas-Louisiana, for instance, will add at least 343,000 short tons per year to butadiene capacity, currently rated at 499,000 short tons per year in the area. G.R.-S. synthetic-rubber capacity, meanwhile, will be increased by 232,000 long tons per year to a two-state total capacity of 803,200 long tons after announced projects are completed.

Four new installations are to be built for production of butadiene and synthetic rubber. These are: (1) **Texas Butadiene & Chemical Corp.'s** butadiene plant near Houston. This plant will have an initial 43,000-ton per year capacity and an ultimate 86,000-ton capacity. The initial installation will be constructed so the plant can be operated to produce alkylate for avgas blending. Output of butadiene and alkylate will be on a sliding scale, each being dependent upon output of the other. Butadiene production will vary from 17,000 to 43,000 tons and avgas output will vary from zero to 2½ million barrels yearly.

2. **General Tire & Rubber Co.** will build a G.R-S. copolymer plant at Odessa, Tex., with a rated capacity of 40,000 tong tons per year. Actually, this plant will be built in conjunction with . . .

3. **The new butadiene plant** to be built at Odessa. Both plants will be built as an integrated unit and represent the first such installation of its kind in the country. General went in on the deal with El Paso Natural Gas Co., which has extensive gas-processing-plant operations in West Texas and New Mexico and is in position to supply raw materials from these plants for butadiene production. The butadine plant will have a 50,000-ton per year



NITROPARAFFINS PLANT of Commercial Solvents Corp., Sterlington, La.

TEXAS-LOUISIANA
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capacity. Most of this will be furnished to General and the remainder to United Carbon Co. El Paso owns 55 per cent of the stock, William D. Noel and associates own 25 per cent, and United Carbon the remaining 20 per cent.

4. **Firestone Tire & Rubber Co.** plans to build a 40,000-ton butadiene plant near Orange, Tex. The company calls it the initial step in a planned invasion of the petrochemical production field. It followed up with a second step shortly thereafter when it announced plans to build a styrene plant there also.

Increased capacity . . . Firestone has a copolymer plant at Lake Charles, La., with a rated capacity of 99,600 tons. This will be raised to 150,000 tons as part of its expansion program in the synthetic field.

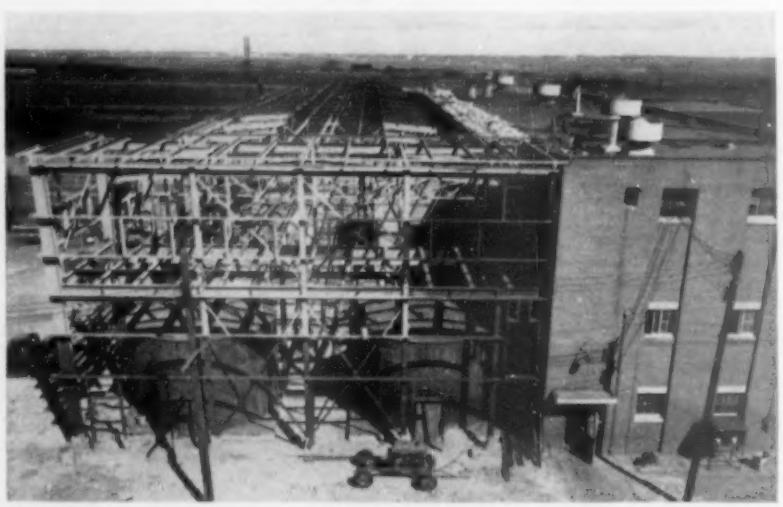
Also at Lake Charles, Petroleum Chemicals, Inc., a joint venture of Cities Service Oil Co. and Continental Oil Co., will add 16,000 tons of butadiene capacity to its 63,000-ton plant. The firm is building a 100,000-ton per year ammonia plant using byproduct hydrogen from the Cities Service and Continental refineries and extracting nitrogen from the air. Major portion of the output will go for fertilizer, although some will be used as raw materials for production of plastics and other petrochemicals.

In Houston, Petro-Tex Corp., a jointly owned subsidiary of Food Machinery & Chemical Corp. and Tennessee Gas Transmission Co., has a major expansion in the works which will increase the butadiene capacity from 90,000 to 135,000 tons yearly. Petro-Tex also is building a $1,500,000 research lab. An adjacent fractionation plant will be built by T.G.T. to provide feed stock for Petro-Tex. Natural-gas products from South Texas plants will be piped into the fractionation plant as a raw mix and then processed to obtain the necessary charge stock for butadiene production. Propane and natural gasoline recovered will be sold to other purchasers.

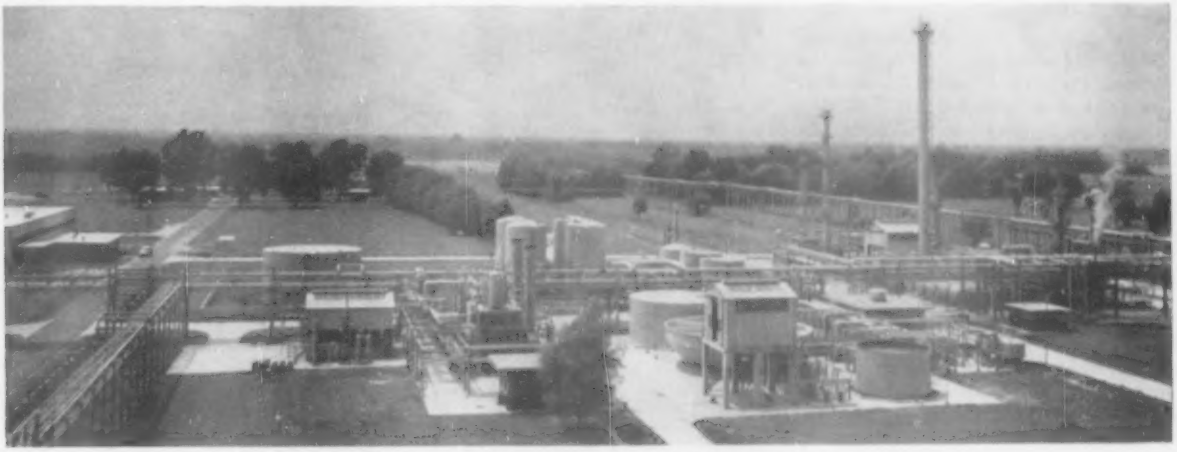
The nearby Goodyear Tire & Rubber Co. also has a major expansion under way at its synthetic-rubber plant which will see production increase by 50 per cent to 150,000 tons per year. At Baytown, meanwhile, Humble Oil & Refining Co. is increasing butadiene production from 49,000 to 65,000 tons.

Port Arthur-Port Neches . . . Neches Butane Products Co., which has the largest butadiene plant in the world at a rated 200,000 tons, is expected to increase output to 300,000 tons per year. It is presently obtaining its butylene feed stock by separarating from tail gases from four nearby refineries. New installations will probably use butane as raw material, with dehydrogenation as the initial process step to obtain butylene.

Butadiene output of Neches goes to feed the adjacent synthetic rubber plants of Texas-U. S. Chemical Co.



SYNTHETIC RUBBER PLANT of Phillips Chemical Co., Borger, Tex. Plant is expanding to a capacity of 108,000 long tons annually.



ALLYL CHLORIDE AND CHLOROHYDRINS plant of Shell Chemical Corp. at Norco, La.

and Goodrich-Gulf Chemicals, Inc. Texas-U. S. has already announced plans to increase production by about 35 per cent to a 135,000-ton anuual rate. Goodrich-Gulf hasn't made a formal announcement but is expected to also make a significant addition. Its plant is currently rated at 90,000 tons.

West Texas . . . During 1955, Phillips Chemical Co. purchased both the Plains butadiene plant near Borger, Tex., which it built and had operated for the Government since 1943; and the Plains copolymer synthetic-rubber plant which it had operated for the Government since 1950. Additions to the copolymer plant, the first phase of which is expected to be completed later this year, will raise the company's trade marked Philprene synthetic-rubber production capacity by 88 per cent to 108,000 long tons per year.

The entire expansion program is expected to be completed by mid-1957. The capacity of the butadiene plant is also being expanded to provide the additional butadiene feed stock for the copolymer plant.

Houston . . . Phillips is building a 110-million-pound polyethylene plant in the Adams Terminal area. Phillips has also purchased a 950-acre tract close by and plans to develop it into a petrochemical center.

Celanese Corp. has already announced plans to build a poly-olefin resin plant at this location. The plant will produce 40 million pounds of Fortiflex annually under license from Phillips. M. W. Kellogg Co., meanwhile, purchased a tract near the Phillips property. Kellogg has announced plans to get into the polyethylene business but has not settled on a definite location.

In the over-all planning, Phillips will have an ethylene supply at its Adams Terminal site. The gas will be received via a 75-mile pipeline from the Sweeny refinery ethylene unit now under construction. This ethylene pipeline could be extended to the chemical center and feed plants located there. The ethylene plant will have a design capacity of 290-million pounds per year. Phillips also will build a Gulf Coast plant to produce 64 million pounds annually of oil furnace blacks.

Also in Houston, Shell Chemical Corp. placed a second bisphenol A unit on stream. This intermediate is used in the manufacture of epoxy resins. Greater capacity will be needed to supply a third resin plant which is due for completion this fall.

Rohm & Haas Co. completed a plant for manufacture of acrylic chemicals at its nearby plant this year and then announced a construction program which will include facilities for manufacture of acetylene, ammonia, and methanol. The acetylene unit will use natural gas as a base raw material and will, itself, be used primarily in manufacture of acrylate monomers.

At Texas City, Monsanto Chemical Co. has a major expansion of ethylene facilities under way. This basic raw material is used by Monsanto to pro-

TEXAS-LOUISIANA SYNTHETIC RUBBER-BUTADIENE PLANTS

Company and location—	Long tons: Annual capacity	Long tons: Expansion capacity
G.R.-S. PLANTS:		
Co-Polymer Corp., Baton Rouge	49,000	
Firestone Tire & Rubber Co., Lake Charles	99,600	50,000
United Carbon Co., Baytown, Tex.	122,000	
Goodrich-Gulf Chem., Inc., Port Neches, Tex.	90,000	
Goodyear Rubber Corp., Houston	99,600	50,000
General Tire & Rubber Co., Odessa, Tex.		*40,000
Phillips Chemical Co., Borger, Tex.	63,000	45,000
Texas-U. S. Chemical Co., Port Neches	88,000	47,000
	611,200	232,000
BUTYL RUBBER PLANTS:		
Humble Oil & Refining Co., Baytown	43,000	
Esso Standard Oil Co., Baton Rouge	47,000	
	90,000	

Company and location—	Short tons: Annual capacity	Short tons: Expansion capacity
BUTADIENE PLANTS:		
Co-Polymer Corp., Baton Rouge	23,000	
El Paso Natural Gas Co. et al., Odessa		*50,000
Firestone Tire & Rubber Co., Orange, Tex.		*40,000
Humble Oil & Refining Co., Baytown, Tex.	49,000	16,000
Neches Butane Products Co., Port Neches	200,000	100,000
Petroleum Chemicals, Inc., Lake Charles	63,000	16,000
Petro-Tex Corp., Houston	90,000	45,000
Phillips Chemical Corp., Borger, Tex.	74,000	24,000
Texas Butadiene & Chemical Corp., Houston		*43,000
	499,000	334,000

*New.

duce polyethylene, styrene monomer, vinyl chloride monomer, and other products. Monsanto also placed on stream the first commercial unit for production of tertiary-butyl amine. It represents a major move by Monsanto into the field of aliphatic amines.

Carbide & Carbon Chemicals Co. is constructing additional vinyl acetate facilities at its major plant in Texas City, with completion anticipated this fall. Meanwhile, down the coast at Seadrift, Carbide has started another round of expansion at its relatively new plant there. Ethylene glycol production will be increased by 65 million pounds annually and ethylene oxide production boosted to 200 million pounds per year. Carbide will also more than double ethanolamine output.

In South Texas, Celanese Corp. has completed facilities designed for aldoling operations at its Chemcel plant near Bishop. Among its products are 3-methoxybutanol and trimethylpropane, used in hydraulic fluid trades and production of polyurethane and alkyd resins, respectively. Construction is also under way at Bishop to increase by 25 per cent the plant's output of formaldehyde, methanol, acetaldehyde, and other organic chemicals.

New Orleans . . . Activity is high all over Louisiana, with heaviest concentration being in the New Orleans and Baton Rouge areas.

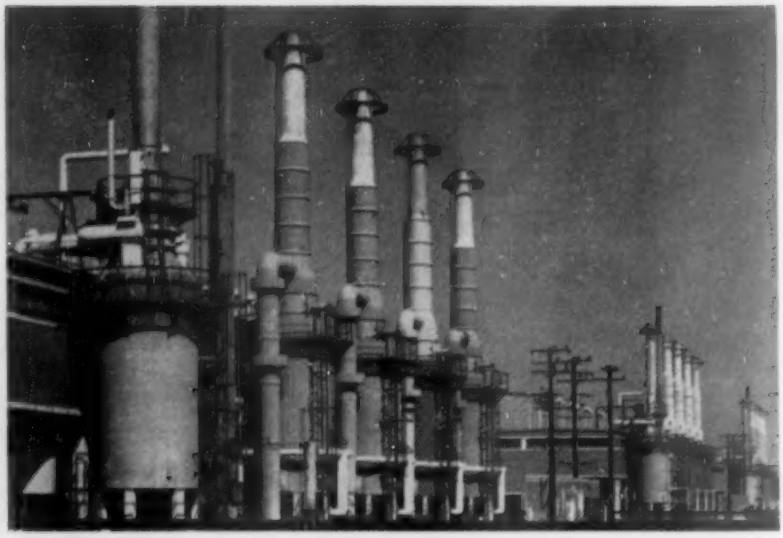
Shell Chemical Corp. opened up its new plant upriver from New Orleans for production of allyl chloride and chlorohydrine. Hydrogen peroxide and acrolein units and a new methyl ethyl ketone plant to produce 40 million pounds per year will add considerably to its output.

American Cyanamid plans to double acrylonitrile output by investing 25 million dollars in new facilities. This is part of a 39-million-dollar expansion program which saw the first large-scale mono-methyl styrene plant placed on stream by Cyanamid. This cost $4,500,000 and has a 30-million-pound yearly capacity. Remaining $9,500,000 is earmarked for acrylonitrile derivatives.

Monsanto, which went into the oil business by acquiring Lion Oil Co., is building a new plant to produce adipic acid at Luling. The new unit will be integrated with Lion's ammonia plant there.

At Gretna, Continental Oil Co. took over Sherwood Refining Co.'s plant. Sherwood was a leading producer of natural sulfonates, white oils, and petrolatums.

At Baton Rouge, W. R. Grace & Co. will use ethylene supplied by Esso Standard Oil Co.'s new plant under construction to produce 50 million pounds of polyethylene per year. Grace also made headlines by acquiring Cosden Petroleum Corp., Big Spring, Tex., which has a refinery and petrochemical plant there. Cosden is building an 18-million-pound per year styrene plant at Big Spring.



ETHYLBENZENE CRACKING UNITS at plant B, Dow Chemical Co., Freeport, Tex.

Ethyl Corp., which first announced a $1,500,000 addition to its Baton Rouge research lab to permit further work on petrochemicals, chlorination, organometallics, and electrochemistry, followed this up by announcing a new vinyl chloride monomer plant. The plant is scheduled for completion in late 1957 and will be built at Ethyl's antiknock manufacturing plant there.

Two other newcomers are due to show up in Baton Rouge. Dow Chemical Co. has announced plans to set up a Louisiana division and will build a plant for production of several organic chemicals in addition to chlorine and caustic.

Wyandotte Chemical Corp. will build a 30-million-dollar plant for producing ethylene oxide, ethylene glycol, as well as chlorine.

Foster Grant, meanwhile, completed expansion plans at its styrene plant.

At Sterlington, Commercial Solvents Corp. has been undergoing a significant expansion program. The company first put on stream the world's first full-scale nitroparaffin plant. The new family of chemicals has a wide range of application as intermediates in manufacture of other products. They can be used to produce new corrosion-resistant plastic materials, as aviation fuels at high altitudes, in production of synthetic fibers, and in making agricultural fumigants and insecticides. C.S.C. is also expanding methanol facilities at Sterlington.

E. I. du Pont de Nemours & Co., Inc., is building a plant at Beaumont, Tex., for production of Hypalon, a chemical rubber. This will be the first full-scale plant of its kind and will adjoin Du Pont's methionine plant. At the Sabine, Tex., works Du Pont began production of two new polyethylene resins Alathon 37 and 34.

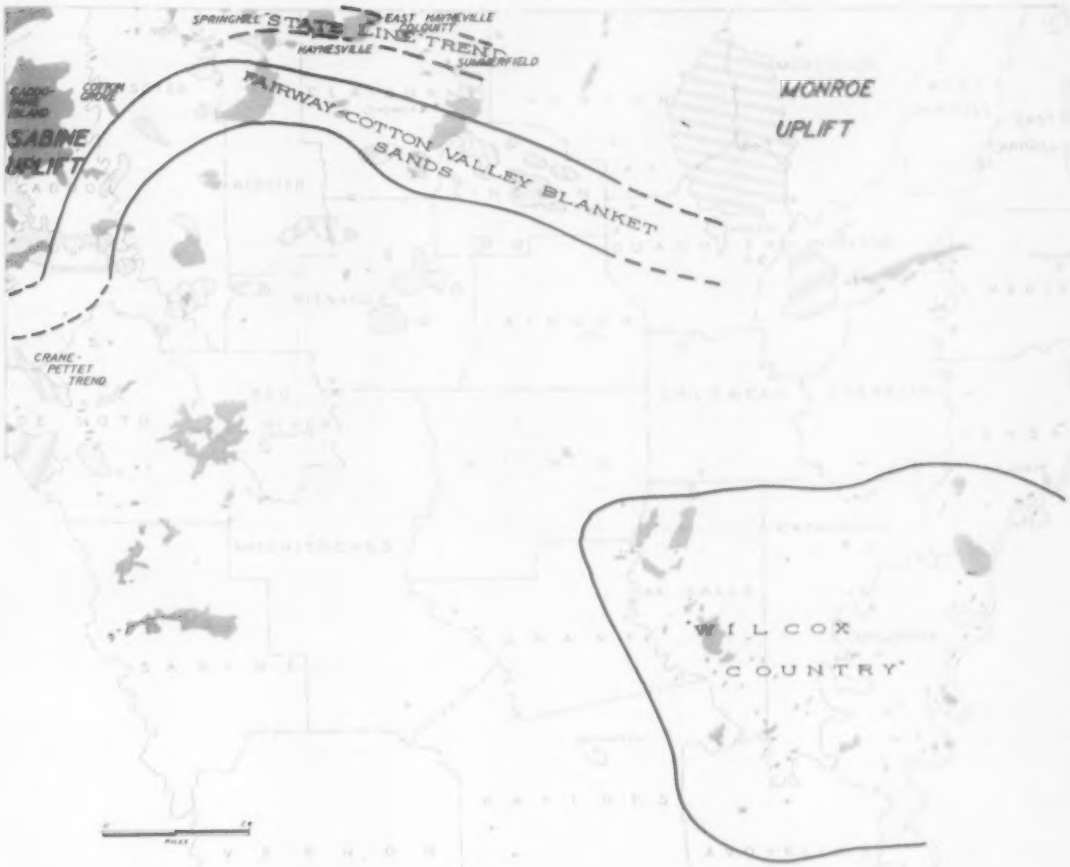
At Freeport, Dow Chemical placed on stream a synthetic-glycerin plant and polyethylene plant, and then announced plans for new production facilities and expansion of existing units. New plants will be built to produce acetylene, methyl acetylene, ethanolamines, synthetic glycerin, and soil fumigants. Expansion will take place in ethylene oxide, methyl chloroform, perchloroethylene, styrene, and butadiene units.

Koppers Co., Inc., has begun full-scale commercial production at the Port Arthur polyethylene plant where it will produce 18 million pounds per year.

At Brownsville, Indoil Chemical Co. is readying its gas-synthesis plant for chemicals production. The former Carthage Hydrocol, Inc., plant is designed to use 90 million cubic feet of gas per day to produce 6,000 bbl. of gasoline, 900 bbl. of diesel fuel, 200 bbl. of fuel oil, and 300,000 lb. of chemicals.

The Nitrogen division of Allied Chemical & Dye Corp. has placed new ethanolamine facilities on stream at its Orange works.

Texas Eastman Co. has announced major expansion to boost output of Tenite polyethylene plastic at its Longview, Tex., plant to a total capacity of 40 million pounds annually. New facilities were also placed in service for increasing production of octyl alcohol and Oxo chemicals for making normal and isobutyraldehydes.



NUMEROUS PAY ZONES and relatively inexpensive drilling make North Louisiana attractive to both the independent and the major oil company. Fig. 1.

Hunting's Good in North Louisiana

It's been combed over for years, but is still good for an occasional surprise

by Norman S. Morrisey

INDEPENDENTS like North Louisiana. The numerous pay zones, relatively low exploration and drilling costs, and the reserves combine to make North Louisiana a good hunting spot. Although the area has been well combed over for years, its oil possibilities are by no means exhausted. Strat plays and fracturing have given oil finders a new lease on life. Deep drilling, too, is paying off with sands in the Cotton Valley formation, and the Smackover limestone as the main objectives.

The piercement salt domes hold out hope for production. Most of the drilling has been for production on the crest of these domes. The flanks have been ignored by many oil companies. The faulting that invariably accompanies salt movement should provide potential oil traps that can be mapped with the seismograph.

Even today, 51 years after its discovery, the Pine Island area in Caddo Parish is active as operators continue to develop shallow Annona chalk production. The zone occurs at 1,400-1,600 ft. and responds readily to fracturing. The wells are profitable and cost less than $15,000 to put on the pump.

Strat traps are the best source of new production in North Louisiana. The Crane-Pettet trend that reaches from Gregg County in East Texas into Caddo and DeSoto parishes was a real eye opener to North Louisiana geologists. And it may be the forerunner of many more stratigraphic traps that are of regional importance. The gas-condensate Crane trend is 93 miles long and 1½ to 2 miles wide, covering nearly 100,000 producing acres. The reservoir is a porous zone within the Sligo formation that occurs at 6,000-6,100 ft. The Pettet production lies in a syncline and is entirely independ-

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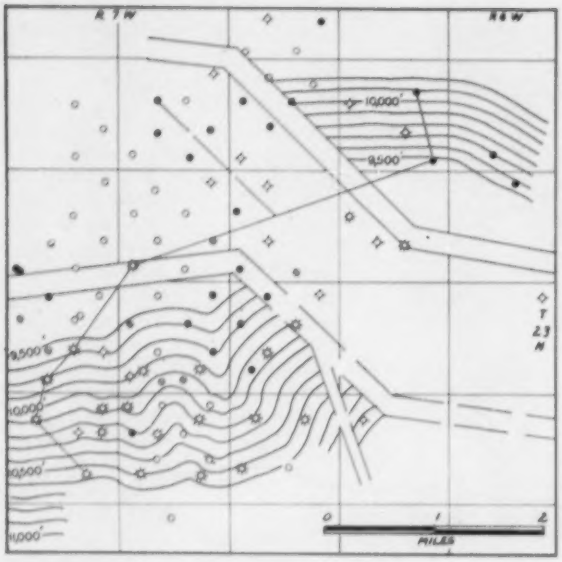


SMACKOVER production along the state-line fault trend is related to a deep-seated graben. (Fig. 2A, left).

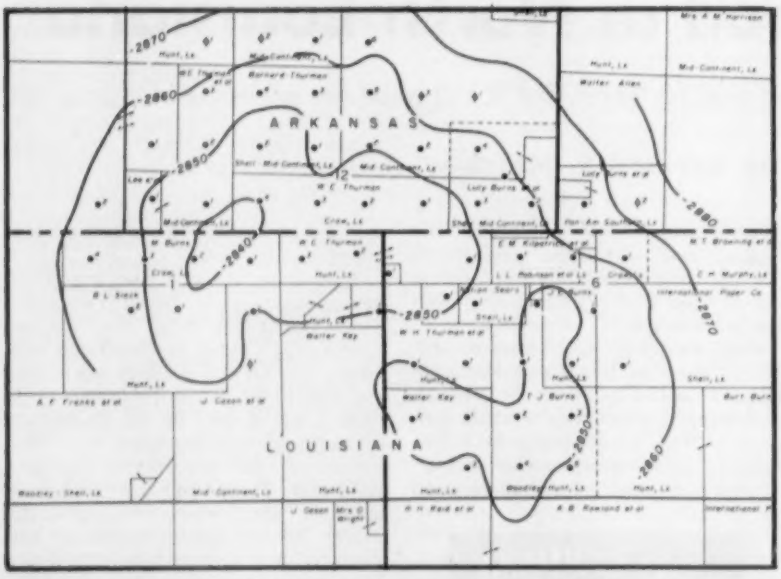
STRUCTURAL cross-section (Fig. 2B, below) shows that the faulting does not affect the overlying Cotton Valley formations. (After John Palmer, Shreveport Geological Society, Vol. III, No. 2).

ent of structure. The wealth of subsurface control in North Louisiana helps the geologist pinpoint the strat traps.

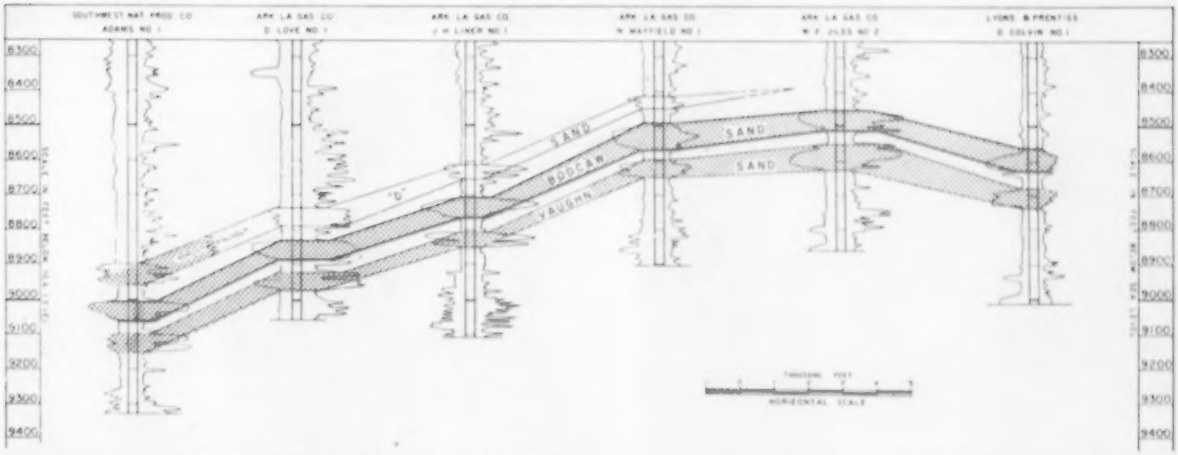
Regional Geology

North Louisiana (Fig. 1) lies on the north limb of the Gulf Coast geosyncline. There are several regional features that have influenced the trapping of oil; among these are the Sabine uplift, the Monroe uplift, and the "state line fault trend."

Nearly all of North Louisiana's structural traps are related to salt movement and are evident as gravity anomalies. Several of the largest Smackover fields show the typical graben common to deep-seated salt domes (Fig. 2). And the state line fault trend, too, may reflect a deep-seated salt ridge. This trend parallels a similar fault trend in South Arkansas that can be traced for hundreds of miles—eastward into



SPRINGHILL FIELD is a low-relief anticline (Fig. 3-A, above) with less than 30 ft. of relief. Production is from the Tokio sand (Fig. 3-B, right) (Shreveport Geological Society Vol. III, No. 2).



AT RUSTON three of the Cotton Valley sands produce: the "D" sand on the south flank, the Vaughn and Bodcaw on the crest of the structure. Fig. 4. (After Breedlove et al.).

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Mississippi and westward into Texas.

Most of the oil production is found in rocks of marine facies or where marine and continental facies interfinger. The location of these facies is of particular significance in isolating areas favorable for future production. For example, the fairway of the Cotton Valley formation lies in a narrow belt extending across North Louisiana. In this zone are many rich gas-condensate and oil fields. Updip in Arkansas, the formation becomes a continental facies and the Arkansas production is relatively unimportant when compared to that in Louisiana.

Geologists anticipate deep Travis Peak-Hosston production downdip from the present producing areas where the rocks are dominantly continental clastics.

Producing Zones

Wilcox . . . Most of the Wilcox (Eocene) production is confined to a small area bordering Mississippi. The producing zones are sands in the Wilcox formation and stratigraphy plays an important role in forming the oil trap. Structures are low relief, and the Wilcox fields are usually small. The pay zones occur at about 5,000 to 6,000 ft. Drilling to the Wilcox is relatively easy and inexpensive. However, since much of the country is swampy, roads can be a major expense item. The high reserves and shallow depths make the Wilcox an attractive target, but the fields are difficult to pinpoint because of the erratic character of the pay sands and the small producing areas.

Upper Cretaceous zones . . . The Nacatoch, Buckrange, Tokio or Blossom, and the Tuscaloosa are the principal Upper Cretaceous sand reservoirs. The Annona chalk, however, has been the main Upper Cretaceous target in recent years. The sand production today is related to both stratigraphy and structure, but most of the structures are low-relief anticlines that are limited in areal extent (Fig. 3). Detailed subsurface mapping is an effective method of finding new producing areas, but the high frequency-high resolution seismic surveys are of definite value in mapping even these small structures.

Lower Cretaceous reservoirs . . . Principal emphasis is on Pettet production in the Lower Cretaceous, but there are several zones in the Washita-Fredricksburg, Paluxy, Mooringsport, and Rodessa that also produce. Travis Peak-Hosston sands, too, are of interest, but ordinarily wildcats are set up for deeper objectives than the Travis Peak. Production from this zone is usually considered as "gravy" or "salvage."

The Pettet is any porous section of the Sligo formation and the zone produces in many fields. Although most of the Pettet production is related to known structures, the possibilities of stratigraphic oil are excellent. The Crane-Pettet trend mentioned earlier is a stratigraphic trap and more production of this type is anticipated in North Louisiana.

Jurassic reservoirs . . . The principal deep targets in North Louisiana are Cotton Valley sands and porous zones in the Smackover limestone. Production occurs in these zones at depths ranging from 8,000 to 12,000 ft.

Several blanket sands are found in the upper part of the Cotton Valley formation. These produce on structure where present. Locally certain of the sands pinch out on the flanks of structures and produce. Along strike, these sands, the D, Vaughn, and Bodcaw, can be followed for many miles. Updip the sands pinch out due to nondeposition (Fig. 4). These blanket sands may represent old shore lines during the time of Cotton Valley deposition.

Within the Cotton Valley are other sands that produce on structures like the Justiss and the Taylor sands.

Deepest reservoir in North Louisiana is the Smackover limestone of Jurassic age. This formation is intimately related to the overlying Buckner or Haynesville formation. Smackover production is controlled by both structure and stratigraphy, but normally is associated with known structures.

References

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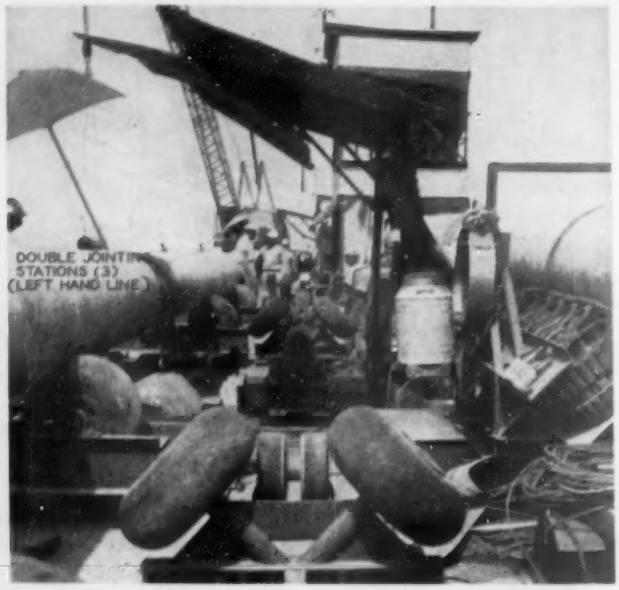
2. "Transactions," Gulf Coast Association of Geological Societies, Vols. I-V inclusive.

"Most of the oil production is found in rocks of marine facies or where marine and continental facies interfinger. The location of these facies is of particular significance in isolating areas favorable for future production."

How Williams Brothers' specially developed barge uses double-jointing

BIG CRANE moves pipe onto lay barge where tractor will take joint to one of three double-jointing stations. Completed double joint is on conveyor rollers.



THREE WORK LINES are visible here. Double jointing is done at left, pipe can be stored or carried forward by center rollers, launching line is at right.

T. G. T.'s "MUSKRAT LINE"

It's 80 Per Cent Submarine—And Here's

by Paul Reed and Robert G. Deering
Pipeline Editor Associate Pipeline Editor

A SIGNIFICANT advance toward high efficiency in submarine pipelining has been made this year by Williams Brothers in barge equipment first applied on Tennessee Gas Transmission Co.'s 355-mile Muskrat project in southern Louisiana from Dixon Bay to Crowley.

In the watery world of the Mississippi River Delta and the coastal marshes of Louisiana, 285 miles of this 355-mile project is submarine pipelining. Three of the longest water crossings were contracted by Williams Brothers which amount to 55 miles of 24-in.

The T.G.T. Muskrat project is believed to be the most extensive submarine gas pipeline in existence. It is the biggest pipeline job in Southwest Louisiana—an area of marshes where trapping, shrimping, and oystering are common occupations. All transportation must be by water or air.

Since the marshy lowlands cannot

RUBBER TRACKS which form V for pipe aid in lining up on launchway for running of stringer bead.

POLYVINYLCHLORIDE tape is used to wrap all field joints.

CONCRETE COATING on field joints was done by two crews.

to best advantage for marine pipelaying.

TWO TRACTORS move double joint from welding station to storage. Crane in background lifts double joints onto launchway where they will be welded onto line.

LAY BARGE moves forward two joints at a time by having winch at rear exert pull on completed pipe. This view is looking forward at time of pull.

How the Pipe Laying Is Being Done

support standard construction equipment and since some 130 navigable bodies of water must be crossed, pipelaying operations are conducted from specially built barges equipped with cranes, welding stations, and facilities for coating and wrapping the field joints.

Deep-water method . . . The Williams Brothers equipment and methods have been specially developed for efficient laying of large-diameter pipe from a barge. The firm's floating plant is an outstanding advance in submarine pipelining. By using three double-jointing stations parallel to the launching line, average output has been between 85 and 90 joints per day—with some days running 100 joints and more for laying about 4,000 ft. (12-hour day).

The basic scheme used on the new barge is adaptable to offshore work in deeper water. As presently equipped the barge can lay pipe in water as deep as 25 ft., the limiting factor now being the length of the spuds with which the barge is held on line. For much deeper water anchors would be used instead of the spuds.

Other features . . . Features of the barge in addition to the three double-jointing racks are the use of half tracks for guiding the launching line, hydraulic jacks for lineup on the launching line, and two large tractors as well as a big crane for moving the pipe.

Should roll welding prove desirable, the double-jointing stations have electric-motor-driven rollers to turn the pipe. Roll welding has not been done on this job.

Altogether the floating unit extends 600 ft., including one 265-ft. barge and one 135-ft. barge for pipelaying and a 200-ft. supply barge.

The basic plan provides for making

Contractor's supervisors are George Littlejohn, left, project engineer, and W. A. Briley, spread superintendent.

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a pull every 12 minutes when 80 ft. of pipe slides into the water for the objective of laying 100 joints per day.

For this program, the pipe is handled on the barges in three parallel lines, each of which is equipped with different types of equipment for holding the pipe:

1. One of these lines has the three double-jointing stations.
2. Next to it is the storage rack for holding completed double joints.
3. Beyond it is the ramp for the launching line.

There are 12 welders on the barges—6 of these are on the double-jointing, and 6 are on the launching line.

Coating is applied at field joints by two crews working simultaneously.

At each pull, the barge is pulled ahead by a winch line lashed to the pipe.

Laying Operations

A step-by-step description of operations should begin with digging of the canal and pipe trench. A flotation canal 40 ft. wide and 6 ft. deep was dug for floating the barges. At the right side of this canal a trench for the pipe is dug deep enough for the pipe to be 10 ft. below mean low Gulf of Mexico level of the water.

Excavation is done by dredges and by 7 and sometimes as many as 11 draglines.

Barges bring pipe coated with coal-tar enamel and 2½ in. of concrete to the front end of the lay barges where they are unloaded by crane.

Each of the two tractors moves a single joint to a double-jointing station. The rod of the lineup clamp is strung through the second joint "on the fly" while the tractor moves the joint into position on rubber-tired dollies.

A complete weld in 20 to 30 minutes is made by two welders at each double-jointing rack for joining two 40-ft. joints to make an 80-ft. joint.

This 80-ft. joint is picked up by the two tractors and moved to the forward end of the barge. Here it is placed on the storage line beside the head end of the launching line. Then the pipe-handling crane lifts the 80-ft. joint onto the launchway.

If for any reason pipe laying is delayed and double-jointing gets ahead of other operations, the storage line between the double jointing and launching lines can hold four 80-ft. joints. Rollers on this line are electrically powered so that double joints can be moved forward without aid of the tractors.

Every 12 minutes when a section of the launching line is pulled into the water, an 80-ft. joint is moved by the crane to the front end of the launching ramp. Meanwhile the 80-ft. joints

Collins Construction Co. lay barge and special

LAUNCHING EQUIPMENT on Collins' barge for 10-in. pull across branch of Mississippi River.

are shifted by the tractors so that an 80-ft. joint is within reach of the crane.

Welding details . . . On the launching line work goes on at five stations—three welding stations and two field joint stations.

Stringer bead (Fleet No. 5—5/32-in.) and hot pass (No. 85—5/32-in.) are run by two welders.

Filler bead (No. 85—$\frac{7}{32}$-in.) is run by two welders.

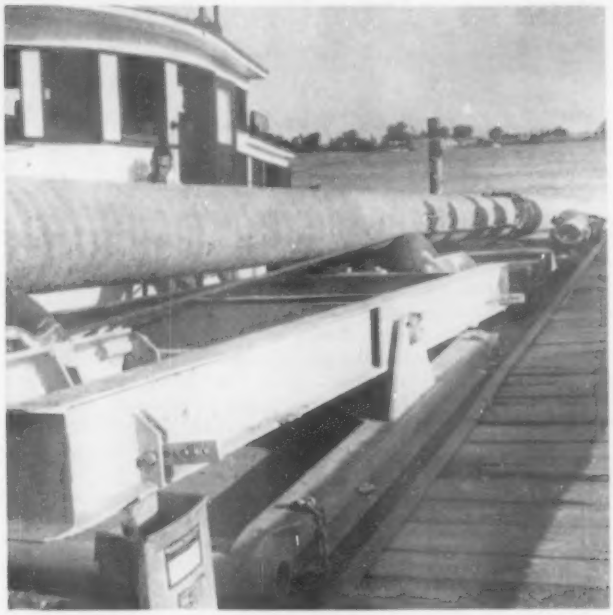
Cap bead (Fleet No. 5—$\frac{7}{32}$-in.) is run by two welders.

Each of the field joint crews does its work in 5 to 7 minutes. First a vinyl

Sharman, Allen, Gay & Taylor launch 4½-mile push.

THIS 10-IN. PUSH along the Southwest Pass of the Mississippi River was being made at a rate of one joint each 7 minutes.

equipment for pulling 10-in. pipe "on bottom" across river.



TEETER-TOTTER launching rollers on Collins pipelaying barge.

SUPPORTING BUOY controls sag as pipe goes in water.

mastic primer is applied which is sticky and rubberlike. This is followed by three wraps of polyvinylchloride tape over the scarfed ends of the enamel coating and over the weld. Then comes a plastic-tape wrap with a 50 per cent overlap over the entire joint.

Finally cardboard forms are placed around the joint, and held in place by steel bands. Concrete is then poured into the forms in which reinforcing wire mesh has also been placed. A cardboard lid is then banded to seal the form and the joint is ready for lowering in.

The lay barges are moved forward every 12 minutes by a winch at the rear end pulling by a wire line attached to the pipe by hook and chain. As the barge goes forward 80 ft. of pipe slides in the water.

A special feature of the loading rack is the halftracks on either side of the pipe which hold it in place. Halftracks have the advantages of ruggedness and flexibility. Also they give more bearing surface than rubber tires and form a definite "V" for the pipe which aids in lineup.

In addition to the equipment described, provision has been made for electric facilities which could be used for rotating the pipe at the double-jointing stations and for moving the 80-ft. joints forward on the storage line. These supplementary electric facilities are available if conditions make it desirable to use them.

On the lay-barge unit, Williams Brothers has a crew of 75 men including the 12 welders and their helpers.

The Williams Brothers lay-barge unit is exceptional in providing adequate welding facilities and fast movement of pipe to maintain high output of big-inch pipe for submarine pipelaying.

After leaving the Williams Brothers barge, the authors were flown in a Tennessee Gas Transmission Co. float plane to two other spreads.

At a point near the Southwest Pass of the Mississippi River, Sharman, Allen, Gay & Taylor, Inc., had taken welding facilities from its barge and had set them up on land for welding 10-in. pipe for a 4½-mile push. Pipe going into a water-filled ditch was floated by pontoon barrels strapped to the pipe. It was reported that pulls were made every 7 minutes. Welding was being done entirely on the launching line without preliminary double jointing. This spread works a 24-hour day.

At a bayou near the Mississippi River, Collins Construction Co., also working 24-hour days, was working from a barge moored close to shore.

All of the 285 miles of water work for the T.G.T. project was done by these contractors: Williams Brothers; Houston Contracting Co.; Sharman, Allen, Gay & Taylor, Inc., and Collins Construction Co. Grayco Constructors, Inc., contracted a section at the west end which is laid by normal dry-land techniques.

T.G.T.'S FLOAT PLANE which carried authors to various spreads on the Muskrat job. Standing are authors, R. G. Deering, left, and Paul Reed.

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Offshore Lines . . . Newest Challenge

OFFSHORE pipelining will have a continuing effect for years on the industry in Texas and Louisiana . . . in new designs . . . new techniques . . . new equipment. Larger and longer lines will be built as increased production piles up. Both oil and gas lines will be extended into waters considered way too deep a few years ago.

The present high cost of marine pipelining will cause methods to be modified, improved, perhaps made cheaper. Marine pipelining is with us to stay. Probably it will always be exciting, expensive, and open to improvements.

In accompanying pages Journal editors have added information on some of the most important lines so far laid offshore and in tidal marshlands, to supplement material in the Houston-A.P.I. paper below. Methods and problems are covered pictorially in the added material.

HERE are some of the basic considerations that must be included in any planning for an offshore pipeline.

1. What route will the line follow for best mechanical protection from wave action and for lowest cost of installation?

2. What part of the route will have the greatest wave action and how will this section be protected: i.e., will it be trenched, pinned down with batter piling, have extra weights, etc.?

3. What weighting material will be used based on economics of pounds of negative buoyance per dollar spent?

4. What values of negative buoyancy should the completed line have? This question requires detailed surveys and corings of the line route to find the characteristics of the bottom. Some sedimentary soils will act as a fluid but have a density of 1.5 or higher. Tests must be made to see if weighting program for the entire line is sufficient for these sections.

5. Will the line be subjected to currents that would tend to wash channels and leave the pipe suspended?

6. What type of coating should be used? And will the change in temperature of the line in water cause too great a stress on the coating due to differential expansion of steel and coating?

7. Will marine organisms be present to adversely affect the coating?

8. Should lay barge or push methods be specified or should the contractor be left to decide?

9. When the pipe is weighted, will the shear strength of the bottom sediments be enough to prevent the line continuing to sink until it acts as a free swinging structure?

What's involved in

Planning and Constructing An Offshore Pipeline

by Clyde Aldridge

The author is senior civil engineer, Magnolia Pipe Line Co., Dallas. Paper presented at pipeline conference, A.P.I. Division of Transportation, Houston, May 14, under the original title, "Offshore Pipeline Planning and Construction."

IN general, the planning and construction of an offshore pipeline parallels that of a land pipeline; however, most aspects will vary to some extent. This variation extends from the initial economic study to final testing.

Lack of pipeline experience offshore and the many unknowns make the planning a long and tedious study. The limitations of available equipment also make the construction extend over a longer period of time than required for a land line.

Economics . . . The economic study of an offshore pipeline involves the consideration of some factors not usually associated with overland pipelines. In addition to the usual factors considered in an economic study, attention must be given to the following:

1. Disposing of the crude petroleum when it is brought ashore: This can be handled as a normal land line would be handled, and will vary according to its location.

2. Tankage. If barges are to be used to transport oil to shore, working tanks must be provided offshore. The cost of offshore tankage will be from 25 to 50 times that of onshore tankage. If the amount of oil to be moved is large, say over 50,000 bbl. per day, this becomes a very large item in the final cost.

3. Movement on schedule. Because of bad weather, the movement by barge from offshore locations will not always be on schedule. If a large amount of offshore storage is not provided, production will have to be shut in. The resulting loss of production, workovers caused by shutting in the wells, and damage to the reservoir are factors in favor of a pipeline rather than barge or tanker movement.

4. High cost of barging from offshore. If small amounts of oil are to be moved, barging may be economical, but as the production increases the cost by pipeline will be cheaper. With 20,000 bbl. per day the barge cost will be about five times as much as pipeline cost. These figures are dependent on many things, such as distance from shore, depth of water, etc. In general, the farther from shore the production is, the more feasible the pipeline becomes.

5. Natural gas. A pipeline is the only method by which natural gas can be brought to shore. This also brings about the study of the pipeline as a two-phase operation.

In the end the cost of the offshore pipeline will probably be 2½ times that of a comparable land system—at present-day costs—but, considering the aforementioned, it will still be feasible to build.

to Pipeliners

Only when the questions listed and many others have been answered from a strictly engineering viewpoint can a line be thought of as being adequately planned.

Then when construction actually starts, designers will find that myriad of problems and questions haven't been thought of or answered.

Laying Methods

The young art of offshore pipelining has so far come up with two basic methods of laying pipe.

One is the familiar stovepipe method using lay barges. Single or sometimes double joints are added onto the main line as it goes into the water.

The other method is the push or pull method with its two main variations—floating pipe into place or pulling it into place on bottom. In this method large sections are welded together on land then pulled into place.

Both methods have disadvantages for offshore work. Depth of water, amount of marine traffic, strength and direction of currents usually determine which method a contractor will use. For strictly offshore work the stovepipe method using lay barges has been used for the last two big lines laid.

For protected waters the flotation method is probably the fastest and cheapest. But its use requires a working

CUTTING DITCH for an offshore line. One big problem for planners of marine lines is whether and where to bury lines. Government regulations require burial of lines in all water up to 15 ft. deep. For protection against barnacles, scour currents, boat anchors, etc., it may be wise to bury the line in much deeper water.

Weather

Probably the most important factor to be considered in offshore construction is the weather. With present equipment it is the controlling factor most of the time, and as the line progresses seaward, it becomes even more of a problem.

There is a weather service available in addition to the governmental agencies. However, forecasts of bad weather that do not materialize can be costly to the contractor in time lost. The occurrence of an unforecasted storm can be disastrous to a contractor if he is caught a long way from shore. While the forecasting is generally good, the weather risk to a contractor is still considerable.

An everyday effect of weather is the waves resulting from strong winds. The heights of waves and the percentage of time that they occur vary according to the time of year, depth of water, and distance from shore. Little time is lost in the bay areas and the first few miles offshore as a result of high waves, but time loss increases rapidly as the line progresses seaward. Some time is lost in the bay areas during the winter months because of the low tides resulting from strong north winds.

To illustrate this point—at the Pure Block 32, Eugene Island area, 15 miles from shore in 10 ft. of water the waves will be more than 4 ft. in height more than 5 per cent of the time; during January, 6.3 per cent of the time; during September, 5.7 per cent of the time; during October, 8.7 per cent of the time.

At the Magnolia Block 45, Eugene Island area, 25 miles from shore in 20 ft. of water the waves will be more than 4 ft. in height more than 5 per cent of the time; during January, 14.5 per cent of the time; during February, 6 per cent of the time; during March, 14.8 per cent of the time; during April, 10 per cent of the time; during September, 5.4 per cent of the time; during October, 15.1 per cent of the time; during December, 10 per cent of the time.

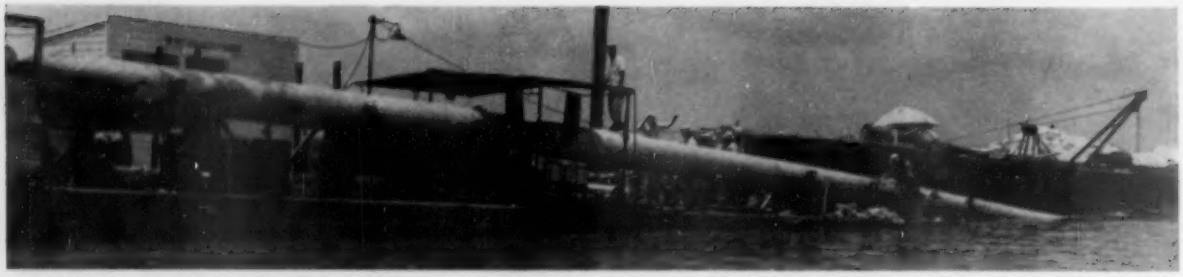
At the Magnolia Block 110, Eugene Island area, 40 miles from shore in 24 ft. of water the waves will be more than 4 ft. in height more than 5 per cent of the time; during January, 20.6 per cent of the time; during February, 11.6 per cent of the time; during March, 31.5 per cent of the time; during April, 24.5 per cent of the time; during May, 12 per cent of the time; during June, 10.3 per cent of the time; during August, 6.9 per cent of the time; during September, 15.6 per cent of the time; during October, 22.8 per cent of the time; during November, 6.5 per cent of the time; during December, 11.9 per cent of the time. These figures are long-range forecasts, and from actual experience seem to be very conservative.

However, the trend is evident that the farther the line goes from shore the rougher the water is over a higher percentage of the time. This restricts the probable working time, as the distance from shore becomes great, to the summer months which include the storm or hurricane season.

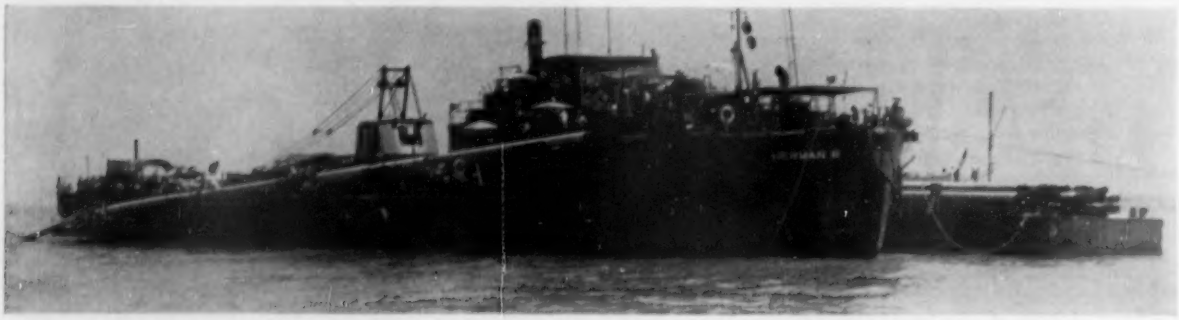
Depth of water . . . In general, the water deepens progressively as the distance from shore increases; however, in some instances, water as deep as 50 to 75 ft. does occur near shore.

The problem of lowering coated pipe—concrete—is multiplied by increased water depths if the coating is not to be damaged. In 30 to 35 ft. of water this can be done with one or two supports behind the lay barge; in 100 to 150 ft. of water an extensive lowering device is needed. In general, the deeper the water the rougher it becomes, thus further complicating the lowering-in processes. The deeper water also complicates the use of a suction dredge in the ditching operation.

In the deeper water not only wave action affects the pipe laying, but also, ever-present ground swells complicate



LAY BARGE AT WORK on offshore line. Boom on supply barge helps support pipe as it enters water so as to protect concrete against bends that would cause cracking.



FIRST BIG OFFSHORE LINE was laid by this converted LST. Vessel is held on line by five anchors connected to winches. Sea-going hull such as this instead of a flat bottom is needed for operation where wave and swell action may be severe a large part of the time.

space where the long sections can be welded before the push. Also, if navigable channels are to be crossed, this method may interfere with traffic.

Where pipe can't be floated into place it can usually be welded into sections and pulled into a dredged ditch. But with big pipe in long sections, very close control is required to keep on line and on proper vertical station.

The most critical part of such a job with long sections

"Pipe burial is one of the most controversial... aspects of offshore pipelines"

operations. Some thought should be given to the use of a barge as a breaker to the waves and ground swells with the laying barge working on the lee side in quieter water.

Distance from shore . . . Some of the effects of the distance from shore have been discussed in relation to weather and depth of water. The other main aspect is the increased supply problem. Although light equipment is satisfactory at present, lines laid 100 miles offshore will probably require larger and more seaworthy equipment. It will probably make necessary the housing of the work crews either on or near the laying equipment.

Pipe Burial

Pipe burial is one of the most controversial of the many aspects of offshore pipelines. However, it is mandatory by government regulation to bury offshore lines in water less than 15 ft. in depth. Ditching by any method is both slow and costly as compared to land work and becomes increasingly more so as the water depth increases.

The basic reason for not burying the lines is cost reduction. The basic reasons for burying the lines are:

1. To provide protection against corrosion.

2. To provide protection against marine life.

3. To provide protection against movement by breakers.

4. To provide **some** protection against dynamiting and hanging anchors.

5. To provide adequate support under the line to prevent spanning.

If the line is to be buried, there are several methods that may be used—a particular method adapting best to certain types of soil and water depths. The bucket-type method, i.e., clam shell or drag line, is probably best in heavy clays, stumps, shell, and in shallow water. A combination of jet action and suction dredge is probably the best method in lighter soils and in deeper water; however, its use in deep waters, say 100 to 150 ft. in depth, becomes complicated. Conventional suction dredges are not considered economical for shallow pipeline ditches. None of the equipment will make ditch as rapidly or as cheaply as might be desired.

Location

Inasmuch as marking of the line is either impracticable or very expensive, a great deal of effort is necessary to lay the line in such manner that it can be relocated with ease. There are probably several methods of control. The most accurate is to use a transit man to maintain direction. The most practicable is to set buoys on a transit line at close intervals along the route and check with transit at certain times as the line is laid. The accurate location of the pipeline is basically important at two different times:

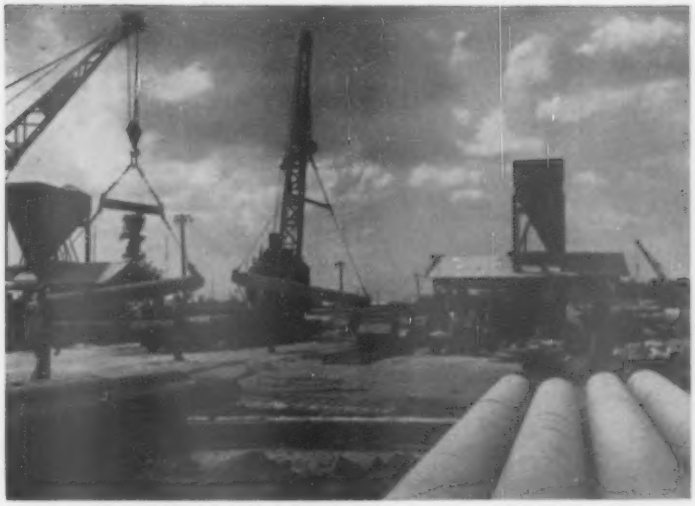
1. When a structure is to be built in the vicinity of the pipeline.

2. When a tie-in is to be made on the pipeline.

Being unable to locate the pipeline immediately when desired can result in the expenditure of a great deal of money.

Methods of Construction

The two methods of construction in general use at present are: (1) the barge-laying method; and (2) the pull-push method. As used to date in the Gulf



CONCRETE IS APPLIED up to 3 in. thick for weight. It also protects coating on marine lines against attack by barnacles. For use in salt water, these joints of 24-in. may weigh up to 7½ tons.

CONCRETE FIELD JOINT is made just before lay barge moves up and pipe goes into water. Hot enamels and, recently, plastic tape are used to coat field joints before applying concrete.

is in control of negative buoyancy during the pull. With too much weight the line causes too much drag. With not enough negative buoyancy it will be difficult to handle long sections through waters having heavy currents or where wind and waves are a factor.

New pull method . . . One of the latest methods devised for offshore work is the "friction transposition" method of Collins Construction Co. Long sections of anchor chains are laid out along the intended route. These act as dead men for the pipe-pulling barge to pull against as the line is laid. Prime purpose is to keep the barge on correct alignment. Pipe is pulled along bottom and is supported partially with buoys. Supposedly with this method there is no problem with handling pipe in extremely deep water—100 ft. or more.

Lay barges . . . The most-used method for deep water so far has been the conventional stovepipe method where single

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of Mexico, neither is adequate for all conditions.

The limitations of each of the two methods are many:

Barge-laying method . . . By this method all construction activities, except ditching, are consolidated on a barge or ship, the barge or ship moving ahead each time a joint of pipe is welded onto the line. Work can be carried on only in calm weather where the waves are less than 3 ft. to 4 ft. in height. The amount of pipe laid is regulated by the time required for each operation, i.e., welding, X-raying, and coating. A good average for a 10-hour day is 65 forty-foot joints of 12¾-in. by ⅜-in. wall pipe.

Because of the excessive movement of the pipe, construction usually must stop when waves reach a height of 4 ft. or more on the barges presently in use. Excessive insurance rates limit work to daylight hours. Personnel must be moved to and from shore each day. Bad weather can cause supply difficulties. Breakdown on any of the five work stations; shortage of material for any one of the stations; breakdown of draw works, power units, anchor lines, or related equipment will cause all laying operations to stop. Each time the wave action is severe enough to cast the pipe overboard it results in the loss of several hours of working time. Lowering the pipe to the bottom in deep water necessitates additional lowering equipment. Currently the use of this equipment is restricted to calm weather. Fog, also, restricts the use of the barge-laying method.

Pull-push method . . . By this method pipe is welded into sections on land and pulled or pushed to the location, much the same as is done on river crossings. This method is usually used in bay areas with no currents present, or on short gathering lines where precise control of the location is required. The amount of pipe laid is regulated by the length of section used.

Because of the effect of currents on pipe with a small negative buoyancy, accurate placing of the line on a predetermined location is either impossible or expensive; in fact, control of it may become impossible. On the ocean end of the line there may not be a platform available as a pulling station, thus necessitating the use of a barge. If the line cannot be pulled for the entire distance, one or more tie-ins must be made. This is an expensive operation and is impossible in bad weather with present equipment. With proved equipment currently in use in the gulf, the pull-push method of laying pipelines is highly restrictive.

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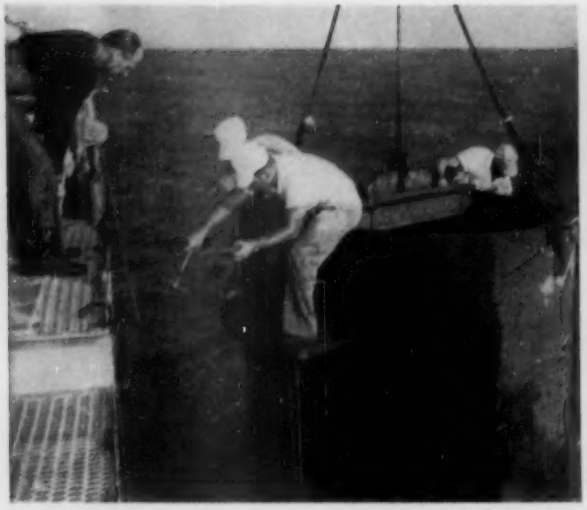
At the present time the amount of marine pipelines laid each year is small. They are usually planned well in advance of their actual need, thus affording the contractor the opportunity of selecting the best time of the year weather-wise to plan the construction.

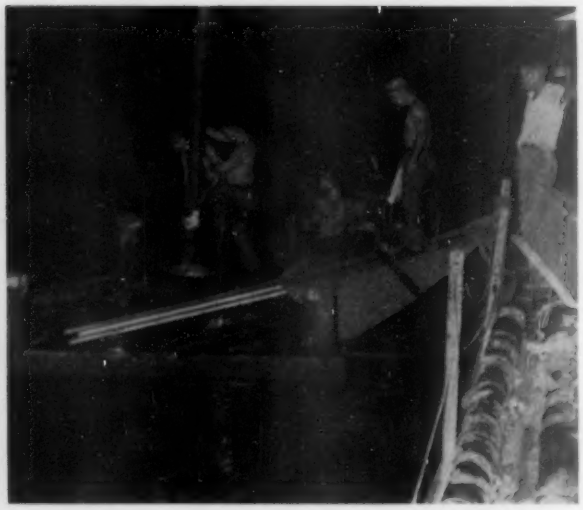
As more wells are drilled and they are located farther offshore, more pipelaying equipment capable of working a large percentage of the time will be needed to reduce the cost of laying pipe.

While we have laid 50 miles of offshore pipeline, there are still many questions to which we do not have adequate answers.

It is assumed that as more and more offshore pipelines are built, the competition will become greater, resulting in reduced costs, in better construction methods, and in more efficient construction equipment.



TIE-IN to underwater line was made in open Gulf of Mexico using this split caisson. Caisson here is being tightened around line preparatory to pumping out water. Water depth was about 20 ft.



TIE-IN RISER is lowered into caisson. Hot tap was made in conventional manner after water was pumped out. A permanent platform was built at the tie-in for valve setting.

"One of the toughest and most expensive problems faced in marine pipelining is making a tie-in after a line is in operation."

or double joints are welded onto the line from a lay barge. The longest offshore lines to be built so far have used this method. These are lines of Magnolia Petroleum Co. and United Gas Pipe Line Co. Magnolia's line is a 52-mile 12-in. across Atchafalaya Bay into the Gulf of Mexico and United's line is a 26-mile 14 and 20-in. in the same area.

The thought of using present lay-barge methods in very deep water has caused considerable concern to pipeliners. Of course as water deepens, wind and wave action cause greater construction difficulties. Besides this unless supports are provided, the pipe can be overstressed as it curves off the back of the lay barge. That is, the curve in the line between ocean floor and lay barge would be large enough to cause a permanent set in the pipe.

One method proposed to avoid this trouble is use of supporting buoys at intervals behind the lay barge. These buoys would be attached by cable to cradles which would roll beneath and support the pipe. The net result would be that a steep angle of bend would not occur at point of contact with the bottom.

Coating and Weighting

Choosing coatings and weighting methods for a particular marine job is a ticklish problem of line designers. Weight, corrosion resistance, and resistance to barnacle attack must be considered.

So far the favorite methods have been use of a 1½ to 3-in. concrete coating applied over conventional enamel or over asphalt mastic. This method gives the needed weight and resistance to penetration from marine organisms. A heavy aggregate such as barite, is used for the concrete. A steel mesh wrapped into the concrete reinforces it.

The disadvantage is that the pipe must be yard coated and weighted some days before moving it onto the line. Concrete used in the weighting process should have several days to cure. Then, in handling the pipe prior to laying, there is some danger of cracking the concrete. This would allow water to reach the steel reinforcing mesh which is wound into the concrete coating and corrosion would result. Failure of the reinforcement steel could result in the weighting coat becoming merely unconnected hunks of concrete resting on the line.

To prevent this, elaborate precautions are taken in handling the pipe during laying. Long inclined ramps are built into barges so that pipe will have a shallow angle with the bottom. Also, support is given the line with booms and buoys as the pipe leaves the rear of the lay barge.

Field joints . . . It is established practice now to coat, wrap, and concrete field joints during laying. Until recently hot enamel only was used for the coating, then concrete was applied in a form over the coated joint. Now one company has started using plastic tape as corrosion protection for the joint with concrete applied over that. Quick-setting cement allows the completed joint to be lowered in immediately. Forms for the concreted joint consist of heavy cardboard held in place with steel bands.

To combat the problem of coating cracking, a new asphalt mastic coating has recently been designed using barites for weighting. It serves as both weight and corrosion protection and is applied in thicknesses up to 2 in., depending on negative buoyancy required.

The coating can be applied directly on a lay barge in a continuous operation so that field joints will be eliminated. The coating requires no special handling to prevent cracking and can withstand any degree of bend that will not damage the pipe.

Laterals and Tie-ins

One of the toughest and most expensive problems faced in marine pipelining is making a tie-in after a line is in operation. So far two methods have been used. One requires raising the line to do the work out of water and the

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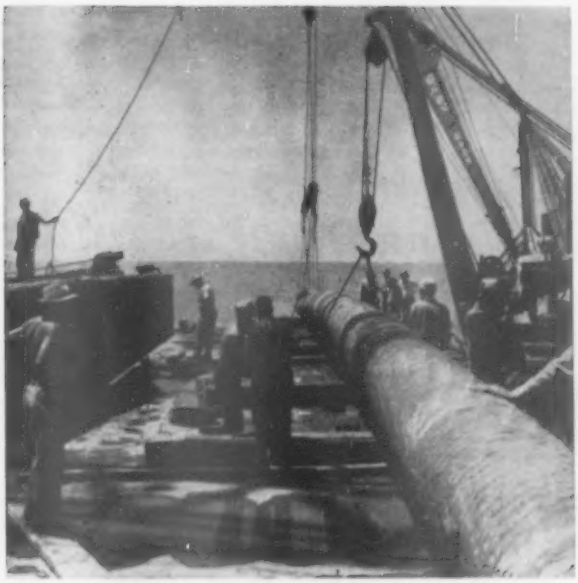


RAISING LINES for tie-in is only other method available. Offshore this presents big problem in getting good welds because of pipe movement due to swells, wind, and wave action.

VALVES ARE TOUGH TO COAT for complete protection against corrosion. This is block gate in gas line which is coated and weighted.

"The best answer to marine tie-ins lies in the future when someone develops a satisfactory means of making underwater welds."

other uses a chamber around the line in place, the chamber being evacuated and kept waterfree.

Where production is well developed before lines are laid, designers can plan for laterals and install stubs during initial construction. If feeder lines must be tied in to a live line the job can become quite complicated.

Accompanying pictures show how Brown & Root, Inc., made a tie-in for Magnolia Petroleum Co. last year. The work was on Magnolia's 12-in. crude line in the Gulf of Mexico.

Essentially the work proceeded as follows: Aldridge opened the ditch for repairs. Then the split caisson shown in the photo was lowered onto the line with the bottom end open. A diver helped spot the shell around the line. When in place, hand winches pulled the bottom end together around the line. Foam-rubber seals in the opening for the main line helped seal off the sea.

Pumps were then used to empty the caisson and a welder went down and welded on a flanged tee and installed a valve. Then a tapping machine made a hot tap in the line, was removed, and the permanent riser bolted on. A permanent platform supported the riser for the tie-in and valve above water.

An expensive part of making tie-ins after a line is laid is finding the old line. Some have advocated placing capsules of radioactive cobalt in the coating during initial laying so that radiation counters could be used to locate the line. It is thought by many that this would be a needless expense. Detecting coils of magnetic-type locators can be made watertight and could be operated to locate underwater lines just as easily as underground lines. Marker buoys have been considered but requirements for light make them impractical.

Of course the best insurance against having trouble in locating lines is in pin-point surveying during construction. This may mean setting up temporary platforms within sight distance of shore and extending survey lines from there on out for as long as the line extends.

Radio location methods used in the gulf by exploration companies will also be used in future offshore work. The Lorac method in particular boasts an accuracy of a few feet within range of stations along the Gulf Coast. *(See The Oil and Gas Journal, December 13, 1954, page 94).*

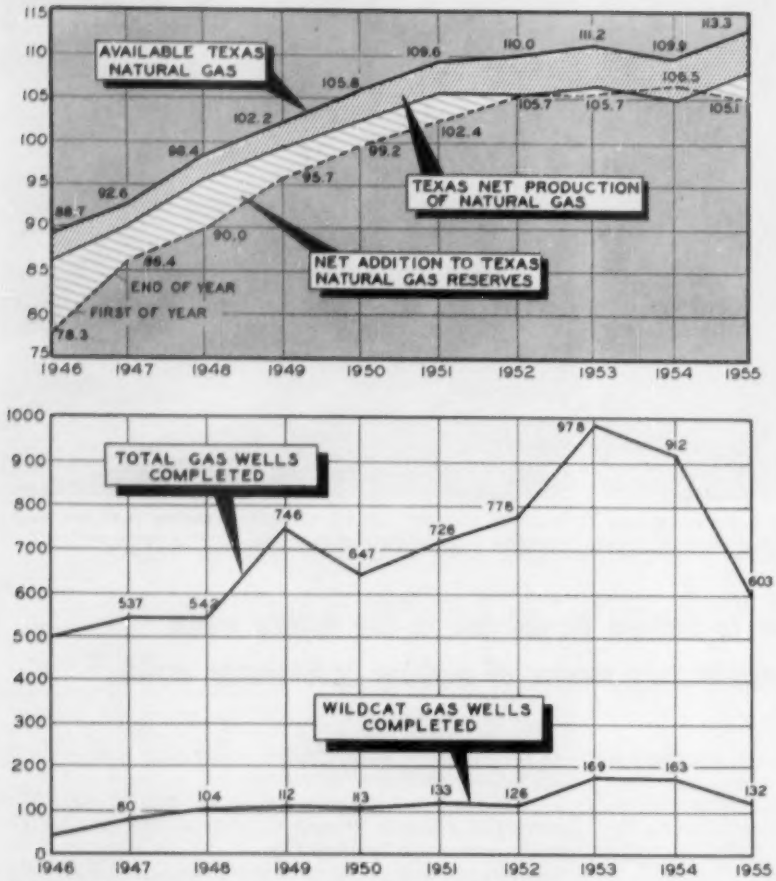
Raising lines . . . The other method used to date for making tie-ins to marine lines is to merely strip out a long section of the line and raise it out of the water. This, of course, presupposes that work is done in shallow enough water that little slack would be needed. In depth over 12 to 15 ft. this will not usually be practical.

In addition to the depth limitation, raising a line causes stress on pipe and concrete coating. Damaging the coating by cracking may lead to corrosion of the steel reinforcing mesh and consequent spalling off of large sections of the concrete. This would then leave the corrosion-preventing coating on the pipeline unprotected.

Welding . . . The best answer to marine tie-ins lies in the future when someone develops a satisfactory means of making underwater welds. Then a diver could install a flanged tee valve, and tapping machine and the tie-in could be made just as in a land job. Work on such a method is going on at this time.

Coatings of valves . . . Any tie-in that is made after a line goes into operation will of necessity include a valve which will be submerged. How to protect this equipment against salt-water corrosion is another unsolved problem. Of all pipeline equipment, valves are the hardest thing to coat completely and adequately. The best coating possible plus local cathodic protection by magnesium anodes is indicated for this problem.

TEXAS GAS . . .



NET ADDITIONS to Texas' gas reserves have declined steadily in recent years, except for 1955, when more than 3 trillion cubic feet was added, despite a 33 per cent decline in gas-well completions. Fig. 1.

. . . where will it come from . . . TOMORROW?

by Frank J. Gardner

WHERE will Texans turn in their search for gas reserves in the future? The big state now holds approximately 48 per cent of the nation's proved reserves, and it is plain to see that the entire country will be largely dependent on Texas for this valuable resource for decades to come.

To Texans, this is a major responsibility. They realize that an intensive search for new supplies must be constantly pushed if they are to supply their quota of one-half the vastly increased demand that lies ahead.

This article is a revised version of a paper presented before the ninth Oil Recovery Conference, Texas Petroleum Research Committee, Texas A. & M. College, April 9, 1956, under the original title, "Future Sources of Natural Gas in Texas."

Reserve additions are down . . . An examination of the chart on newly discovered gas reserves during the past 10 years (Fig. 1) reveals a steady decline in net added reserves from 1951 to 1955, and a steadily declining rate of gas-well completions since 1953. In 1952 the net addition to gas reserves in Texas was zero; in 1953 very little was added, and in 1954 the state actually dipped into its reserves for production and showed a net loss. In 1955, despite a 33 per cent drop in gas well completions, a net addition of more than 3 trillion cubic feet of new reserves was achieved. These are the reserve figures released by the American Gas Association; the figures on well completions are from the records of The Oil and Gas Journal.

Enormous task ahead . . . To keep reserves ahead of production, then, Texans are faced with a monumental task of new gas discovery. In spite of the paradoxical implications of the chart in Fig. 1, it has been proved that the more wells drilled, the more reserves added. This means that the Texas wildcatter must look forward to a constantly accelerated drilling program in future years if the gas goal is to be attained.

Proven Provinces

It is a little astonishing to realize that the proven gas reserves of Texas, as now known, are concentrated in a relatively few fields. Of the total reserve, 10 per cent is dissolved gas in oil; 15 per cent is associated gas (gas caps, etc.); and 75 per cent is nonassociated. This 75 per cent nonassociated gas, interestingly enough, is concentrated in only 22 major gas fields of the state. The other 25 per cent (dissolved and associated) is contained in 62 large oil fields that in turn represent 70 per cent of the total recoverable oil in Texas.[1]

The location and distribution of these presently known reserves is shown grahpically in Fig. 2. The circled figures on the map show the relative importance of the various state districts insofar as gas content is concerned. The upper Gulf Coast ranks first, the lower Gulf Coast second, the Panhandle third, the West Texas area fourth, and the smallest total reserve lies in East Texas.

Oil and gas are usually found together; finding the one means finding the other, and most gas fields have been discovered as a direct result of the search for oil. There is no reason to doubt that the pattern will continue. Hence, every "future oil province" automatically becomes a future gas province.

Pursuing this premise, we can interpret the future in the light of the present insofar as established oil provinces are concerned. It is safe to assume that the greatest number of undiscovered

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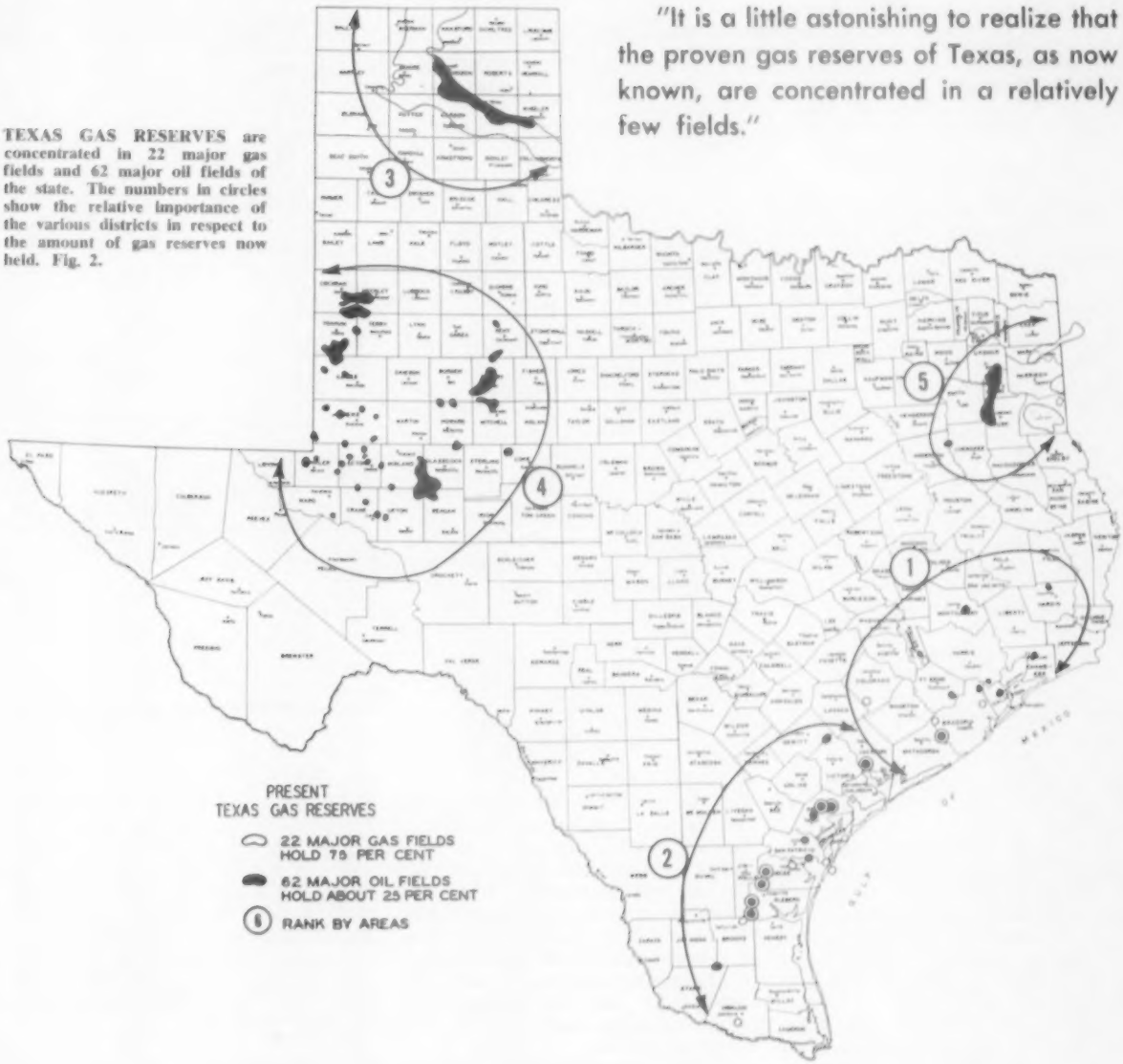


TEXAS GAS RESERVES are concentrated in 22 major gas fields and 62 major oil fields of the state. The numbers in circles show the relative importance of the various districts in respect to the amount of gas reserves now held. Fig. 2.

gas reservoirs in proven provinces must lie in the Gulf coastal area, the next greatest number in the Panhandle area, and so on.

Future Provinces

But what of the unproved province? Where in Texas can the wildcatter of tomorrow concentrate his search with a better-than-average chance for success?

Admittedly, Texas is growing short on "virgin" or undrilled provinces; but there are many sparsely drilled ones, some with less than half a dozen wildcat tests on record, and their tremendous areal extent makes up in expanse what is lacking in numbers.

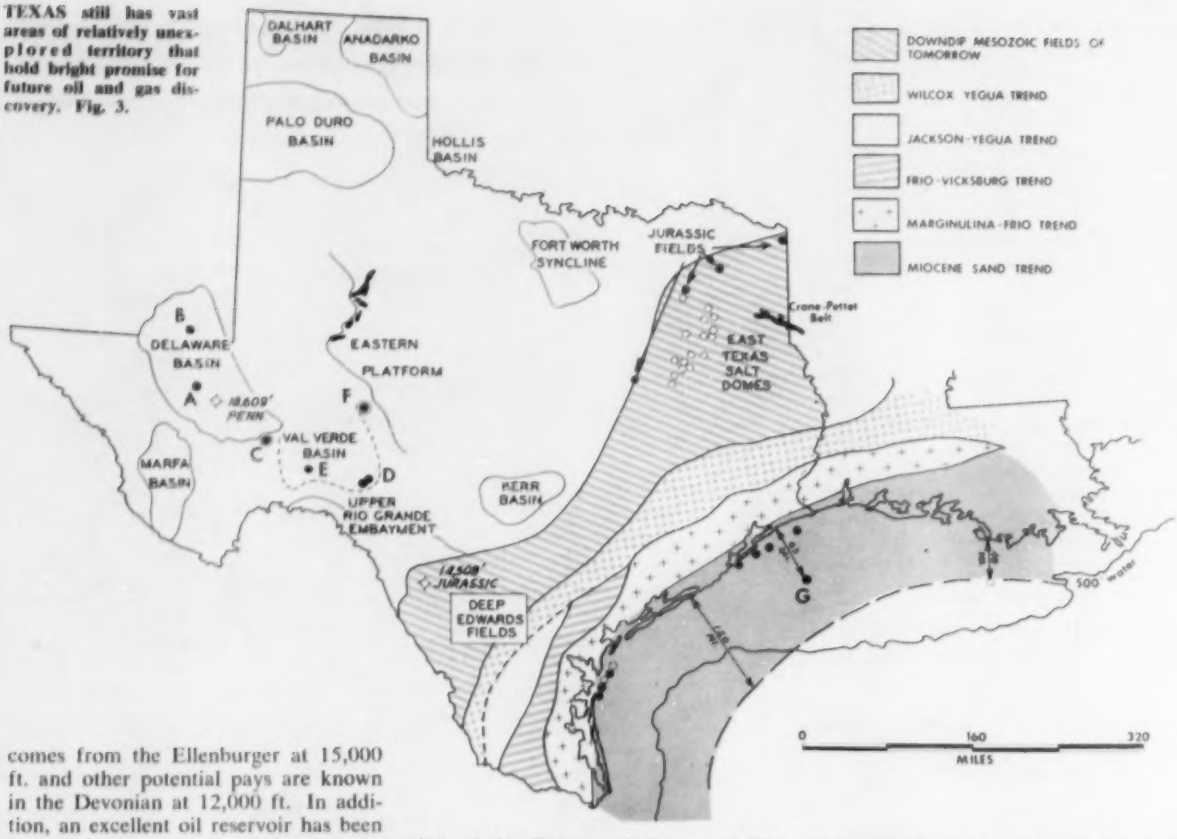
Fig. 3 spotlights the most promising of these future provinces for gas (and for oil). Some of these are undrilled or sparsely drilled, while others are in established oil and gas country, but hold bright promise of deeper production.

West Texas . . . The Permian basin province today is witnessing the gradual emergence of two subprovinces as important gas sources. These are the **Deleware basin** and the **Val Verde basin.**

The **Delaware basin** has been a tantalizing target for years, and it has paid off with many shallow Permian fields. But geologists believe that it holds productive possibilities as great as those of the Midland basin. The great deterrent to discovery is depth. To tap the same rocks that are yielding the flush fields of the Midland basin, operators west of the Pecos wil have to drill holes deeper than 20,000 ft. So far, the deepest well (depth-record holder for the entire State of Texas in 1954) went to total depth of 18,609 ft. (see map) and was still in Pennsylvanian rocks. This is in the deepest part of the basin, and to reach the reservoir rocks of the Mississippian, Devonian, and Ordovician, a target depth of 25,000 ft. may be too conservative.

Two gas fields are already producing from pre-Permian sands in the Delaware basin; these are Toyah field (A on map) in Reeves County, Texas, and Bell Lake field (B on map), Lea County, New Mexico. Here, production comes from the Devonian at 12,700 ft. (Toyah) and from the Pennsylvanian at an identical depth at Bell Lake.

At the southeastern tip of the basin, in the Sheffield Channel (C on map) is Puckett, the best field found so far. Here, flush gas-condensate production



TEXAS still has vast areas of relatively unexplored territory that hold bright promise for future oil and gas discovery. Fig. 3.

comes from the Ellenburger at 15,000 ft. and other potential pays are known in the Devonian at 12,000 ft. In addition, an excellent oil reservoir has been indicated in the Pennsylvanian at 10,000 ft.

Besides the drilling-depth bugaboo, Delaware basin exploration is hampered by seismic deterrents. A thick post-Guadalupe mantle of sediments masks deeper formations and, as one geophysicist puts it, "seismic work continues to vary between difficult and impossible."

Despite these difficulties, the Delaware basin looms as perhaps the best target for the future gas sources in West Texas. A current wildcatting campaign is under way on its east flank where it abuts the west side of the Central Basin platform, and several discoveries have resulted. This may be expected to accelerate in months to come, and when drillers can sink wells to 20,000 or 25,000 ft. economically, the deep play will materialize.

To the east, a sparsely drilled basin currently in the news is the **Val Verde basin,** a southern lobe of the Midland basin, and southernmost component of the Permian basin province. Here, deep (10,000 ft.) Pennsylvanian gas-condensate wells have been found in Vinegarone field (D on map) in northeastern Val Verde County, and a recent discovery produced gas from the Ellenburger at 14,000-15,000 ft. (E on map). The immense stretch of sketchily drilled territory between the southern extension of the Eastern platform and Rio Grande River, embracing Val Verde, southern Crockett, eastern Terrell, and western Edwards and Kinney counties may be expected to undergo extensive wildcat plays in the next 5 years. This is Edwards Plateau country, and seismic crews have found great difficulties in getting reflections, but recent developments with the geograph and other new instruments have met with success.

New successes are anticipated for the **western flank of the Eastern platform,** as sedimentation studies and research on facies-change problems lead to detection of possible stratigraphic traps in that area. There is also an excellent possibility of new reef complexes along the southern extremity of the platform, as evidenced by a recent Pennsylvanian reef discovery in Irion County (F on map).

In the Big Bend country of Texas is the almost totally unexplored **Marfa basin.** Its remoteness has worked against it in the past. But remoteness no longer poses a problem for oil finders, and it stands to reason that eventually this large untested basin will enter the drilling sphere. It offers a thick sedimentary section, including pre-Permian (about which almost nothing is known), Permian, and Cretaceous rocks. Showings of oil have been reported in several wells in the Cretaceous cover, which ranges in thickness from 600 ft. in the north to about 5,000 ft. near the Rio Grande. The geologic section is believed to be similar to that of the Delaware basin, plus the Cretaceous rocks at the surface. There are known anticlines and faults in the basin, and there's an excellent chance for reefs and stratigraphic traps on the basin flanks. This is definitely an exploration horizon for the future.

Texas Panhandle . . . The Panhandle region has undergone a rebirth of activity in the past 3 years, following a rash of oil and gas strikes in the **Anadarko basin** in its northeastern corner; this activity will continue unabated for another 5 years, and the additions to Texas gas reserves may be expected to be substantial.

In the northwestern corner of the Panhandle, the small **Dalhart basin,** brought into production for the first time in 1954, is a prospective source of new gas fields. Current activity is restricted, but it may be accelerated in the next 2 years, provided some stimulus in the form of new strikes is forthcoming.

The largest unproductive basin in Texas, and one that has barely been touched by the wildcatter, is the **Palo Duro basin.** A 32,000-sq. mile basin with a sedimentary section up to 11,000 ft. thick, this vast prospect lies dor-

mant today, with only one active wildcat in it. It cannot long be ignored.

The basin itself is the northern lobe of the Midland basin to the south, and is separated from it only by a series of buried granite peaks known as the Matador "uplift." A thick section of Permian and Pennsylvanian sediments, and a relatively unknown pre-Permian section offer a host of reservoir prospects for both gas and oil. It is difficult to explain the lethargy of Texas wildcatters in respect to the Palo Duro. It's a sitting duck for future exploration, and some geologists feel that it's more likely to yield gas than oil.

East Texas . . . While it can hardly be called a "future" oil or gas province, northeastern Texas harbors a vast gas and oil potential in its deeper reaches that is in a most primitive state of exploration—here is a vertical frontier for future exploitation.

The **"downdip Mesozoic belt"** sweeps across the entire State of Texas from the Rio Grande to Texarkana. The deeply buried Cretaceous and Jurassic rocks are still much of a mystery to today's oil finders, but limited success leads to the belief that they possess a great productive potential. So far, only northeastern Texas has yielded commercial fields from the Jurassic section (see map), while southwest Texas has seen success recorded in the deep Edwards-Lower Cretaceous limestones (white square on map). Most of the Jurassic wells in northeast Texas are gas-condensate producers, some with exceedingly high sulfur content. To this time, only four pools have been found, but future drilling will undoubtedly place the Jurassic squarely into the Texas producing column. The fields will be found all along the major zones of faulting that mark the updip limit of the shaded area on the map.

Another exploration challenge to East Texas wildcatters are the 16 nonproductive piercement salt domes in the deep part of the **Tyler basin.** Geologists have yet to solve the riddle of their barrenness. Some contend that they are not salt domes at all, but residual ridges or salt anticlines, and that they may be flushed clean of any oil or gas that might once have occupied their flanks. This remains to be seen. Meanwhile the 16 structures are an enigma, and until proved dry, must remain in the category of possible future sources of oil or gas.

An anomalous and prolific source of gas and condensate has been discovered in East Texas and western Louisiana during the past 3 years; this is the **Crane-Pettet porosity belt,** a dolomitic trend, devoid of structural expression, that stretches over 110 miles in length. Some geologists feel that similar unorthodox reservoirs might be discovered through astute subsurface study in those areas that flank regional uplifts in the Ark-La-Tex province. If so, the potential for gas and condensate in reservoirs of this type could be most impressive.

"Admittedly, Texas is growing short on 'virgin' or undrilled provinces; but there are many sparsely drilled ones, some with less than half a dozen wildcat tests, and their tremendous areal extent makes up in expanse what is lacking in numbers."

Southwest Texas . . . After years of neglect, the upper reaches of the **Rio Grande embayment** are being subjected to active wildcatting campaigns by several major companies and independent operators. Dominating the entire region is the northwest-southeast fold known as the Chittim anticline, a 125-mile uplift that slashes across the middle of the embayment. In 1955, oil was discovered on the anticline for the first time, although gas had been known on it for many years. The structure should harbor many additional reservoirs on its flanks, but wildcat drilling had been nil until 1955.

The upper embayment embraces 20,000 sq. miles of poorly explored ranchland. It holds Paleozoic, Mesozoic, and Cenozoic sediments 20,000 ft. thick or more, plus a myriad geological structures both on the surface and subsurface. The wildcat drilling density is only one well to 50 sq. miles, and the average depth for all wildcats drilled is a little under 4,000 ft. Recent oil strikes in Maverick and southern Val Verde counties have stimulated interest to the point where the next 2 years will no doubt see many more locations for test wells.

To the southeast, as previously mentioned, is another forerunner of things to come. In the white square on the map, the Standard Oil Co. of Texas, Stanolind Oil & Gas Co., and Humble Oil & Refining Co. are uncovering deep Edwards lime (Lower Cretaceous) gas-condensate pools at depths of 10,000 to 11,000 ft. This deep development can only be expected to expand in all directions. The result will be prolific gas-condensate production throughout the Southwest Texas area.

Gulf Coast . . . Texas' offshore prospects for gas and oil production are good, but not as good as offshore Louisiana. Geologists believe that Texans have no yet stepped out far enough into the water for a fair test of offshore chances. Louisiana was lucky in that Mother Nature arranged for the Mississippi River to build a muddy, swampy bridge out to the prolific Miocene sands that have paid off so handsomely with new discoveries the past 5 years. Texans will have to drill farther offshore in order to reach the same sands, if they are present at all. And the consensus now is that the Miocene belt may play out in the vicinity of Galveston Island, and that wells south and west of there will have to shoot for other types of reservoir sands.

On the map, the Miocene belt has been extended westward from Louisiana in an idealized manner, in order to show the narrowing of the Texas portion of the tidelands "shelf." It will be noted that the fields discovered so far in Texas waters are clustered close to shore (circles on map), but it is entirely possible that future years will see drilling clear out to the 500-ft. water line.

A crucial offshore test now drilling may help to point to Texas' Miocene chances. This well, (G on the map), is to be drilled by Shell Oil Co. 63 miles out from the Jefferson County shoreline. Its log will reveal much new knowledge about the western extent of Louisiana's prolific Miocene sand belt, and the test will be closely watched for this reason.

So offshore Texas is still a mystery. Submerged uplifts are known to be present, and undoubtedly some of them will yield gas fields for the future. How the sedimentary section will stack up against the one off Louisiana is yet unknown, but indications are that it will be less sandy and less promising. Offshore prospecting is still in its primitive stage, directed at the large, "grade A" structures. As time gose on, the search will narrow to the smaller uplifts, and if the section and the reservoir sands prove to be what Texans are hoping it will be, it is highly possible that as much oil and gas will be found offshore as has already been found onshore. At present, however, the outlook is indifferent.

These, then, are the principal targets for tomorrow in Texas exploration. The great need, if gas reserves are to be kept ahead of production, is for new producing provinces.

Reference:

[1]"Texas Gas Reserves Gain 3 Trillion Cubic Feet," by C. A. Breitung, The Oil and Gas Journal, April 16, 1956, pp. 282-285.

FLOWING BOTTOM-HOLE PRESSURE being taken on a Gulf Coast well here is the basis of the reservoir-limit test. Rate is held constant and production is metered at a battery set up for this new well.

GAS PRODUCER, well No. 2, had a potential of 2,800 M.c.f. per day. Logical development was a well to the south. But, this was before the reservoir-limit test. Fig. A.

Gulf Coast Wildcat Verifies . . . RESERVOIR-

by Ed McGhee
District Editor

THE area in the map shown in Fig. A is part of Harris County, Texas. About 2 years ago, a Gulf Coast operator drilled Well 1, a wildcat. It was a dry hole but did have a slight show of gas in a sand at 7,200 ft. On the strength of that show, Well 2 was drilled. Logs of the prospect sand looked good enough that 5½-in. casing was cemented through it and perforations were made from 7,267-72 ft.

The operator then ran a formation test inside the casing. Here are the results of that test:

ONE-QUARTER-INCH CHOKES TOP AND BOTTOM 3,700-FT. WATER CUSHION

Surface pressure, psi.	Time, minutes
1	2
12	5
500	10
1,000	15
1,600	*21
2,400	†60

*Flowing water cushion. †Flowing dry gas only.

The well was tested for 7½ hours and produced gas with a water-white distillate and no water. Flowing tubing-head pressure was 2,380 psi. Flowing bottom-hole pressures were: initial, 2,175 psi.; and final, 2,975 psi. The 30-minute static bottom-hole pressure was 3,100 psi.

In short, the test made the well look like a good one, so tubing was run and the well was completed on December 16, 1954.

Offsets dry . . . Well 3 was then drilled to develop the 7,200-ft. sand shown productive in Well 2. However, Well 3 was dry. So was Well 4 which was drilled immediately afterward.

Because there had been no pipeline connection for Well 2 when it was first completed, it had not been produced during this time. A pipeline connection finally became available for Well 2 in July of 1955 and the well was gaged with an absolute open-flow potential of 2,800 M.c.f. per day. Static bottom-hole pressure was still 3,100 psi. at 7,270 ft.

Still Well 2 looked like a good producer so the question arose as to whether a south offset would also produce gas and make a profitable completion in a 7,200-ft. sand. For that reason, the operator decided to run the reservoir-limit test on Well 2 to get an estimate of the connected gas in that reservoir.

How prediction was made . . . Well 2 was given the RL test at a constant flow rate with a mechanical bottom-hole pressure bomb. Fig. 2 in the article by Park Jones (see page 190, this issue)

by Park Jones

A RESERVOIR-LIMIT (RL) test is a test of a new well which consists of measuring the rate of change of bottom-hole pressure at a constant producing rate at the time the well is put on production. This information, coupled with P.V.T. and physical properties data for the reservoir fluid, then leads to:

1. Barrels of oil or cubic feet of gas connected to the well.
2. Effective darcy-feet of connected pay.
3. Drainage area and effective drainage radius.
4. Well completion efficiency.

The RL test minimizes the chance of drilling unnecessary dry holes. And cost of running it is nominal compared to the cost of drilling a dry hole, especially offshore.

There are actually two RL tests. The constant-rate RL test is used for the usual oil or gas well. The constant-pressure RL test is used on oil and gas wells completed in reservoirs of very low permeability. Wells completed in reservoirs of unusually high permeability can be tested by the constant-rate method only with the aid of either an electronic pressure bomb or a differential pressure bomb. The present-day mechanical bomb is not sensitive enough. This is a preliminary report on the constant rate RL test only.

Author is a consultant, Houston.

How much is a wildcat producer worth? Now you can tell!

The reservoir-limit (RL) described on the following pages predicts the barrels of oil or M.c.f. of gas connected to a new well. Of course, these predictions cannot be proved nor disproved until the well has been produced to depletion. Since this new method was put to work, one of the wells—a high-pressure gas well—has been produced until it died against a 450-psi. pipeline pressure. The prediction made from the reservoir-limit test showed gas connected to this well to be very low. Because the operator acted on the prediction, he saved himself $90,000 it would have cost to drill the offset well he had planned. Here is the history of this discovery well, the reservoir-limit test on it, and its subsequent production.

LIMIT TEST

INFORMATION needed for the test is bottom-hole pressure at a constant producing rate as a function of time. After a plot of these data is made, fluid viscosity determines production capacity, and fluid-volume factor and expansion coefficient determine the amount of oil or gas connected to the well.

RESERVOIR LIMIT TEST

Operator_____

Lease & Well No._____ County_____

I.D. of casing, liner, or open hole_____

Feet perforated or open to production_____

Shut-in hours_____

Shut-in B.H.P. _____ at mid-level of producing interval

Shut-in B.H.P. _____ at mid-level of producing interval

Production test started: Day_____ Hour_____ Minute_____

Elapsed Time, Days	Bottom Hole Pressure, Psia.	Production Rate, Bbl. or M.c.f. Per Day

Reservoir Oil

Pressure_____ Volume Factor_____

Viscosity_____ Compressibility_____ Saturation Psia._____

Reservoir Gas

Pressure_____ Compressibility Factor_____ Viscosity_____

Compressibility_____ Dew Point, Psia._____

Oil or Gas Well

Estimated porosity_____ Estimated interstitial water_____

The RL test includes bottom-hole pressure data, P.V.T. data, computation of the rates of pressure change and the estimation of the connected barrels of oil or cubic feet of gas and of the three other items listed above. The cost of an RL test ranges from $1,500 to $3,000 depending on the duration of the test and on the amount and kind of laboratory P.V.T. data required. The cost may be greater for a high-pressure well.

Rate of change of pressure with respect to producing rate depends on type of fluid flow; reservoir characteristics; properties of fluids; gas-oil or oil-water or gas-water contact; impermeable external boundaries, well interference, and the unloading of a well. Development of equations essential to relating these factors is presented in a separate appendix which has the following sections. (Ed. note: available on request):

(Continued on next page)

is the plot of Y values made for the well. As this figure shows, flow became steady state after about 600 minutes, and Y was 0.045.

Laboratory analysis had already fixed B_o at 0.938 and E_g as 320×10^{-6} per psi. Therefore, the M.c.f. of gas connected to Well 2 was:

$$N = \frac{1}{B_o E_g Y_s} = \frac{10^6}{(0.938)(320)(0.045)}$$

$$= 74{,}000 \text{ M.c.f.}$$

The estimate of connected gas in place was only 74,000 M.c.f.—not much for a well with an open-flow potential of 2,800 M.c.f. per day and not nearly enough to pay for the cost of drilling the well. Nor would an offset well be justified on the basis of this estimate. Therefore, the operator decided not to drill another well, at least until after Well 2 had been produced for a time.

How did the well turn out? . . . The following is a day-by-day record of Well 2:

7-26-55	Well had shut-in tubing pressure of 2,325 psi. Opened on 8/64-in. choke with 2,125 psi. flowing tubing-head pressure.
7-28-55	FTP = 1,950 psi. 5 bbl. water/day
7-30-55	FTP = 1,750 psi. 10 bbl. water/day
8- 2-55	FTP = 1,550 psi. 10 bbl. water/day
8- 7-55	FTP = 1,450 psi. 25 bbl. water/day
8-20-55	FTP = 1,050 psi. 30 bbl. water/day
8-24-55	FTP = 900 psi. 30 bbl. water/day
10- 2-55	FTP = 435 psi. Would not overcome pipeline pressure of 450 psi.
10- 3-55	Well vented to atmosphere, tubing pressure pulled down to zero psi.
10- 4-55	Well dead and abandoned.

The following is the cumulative production from Well 2:

1955—	Oil, bbl.	Gas, M.c.f.
July	100	3,825
August	127	12,744
September	100	1,963
October	11	25
Total	338	18,557

Estimate vs. production . . . Original estimate of connected gas was 74,000 M.c.f.; and the well produced 18,557 M.c.f. before dying. Percentagewise, this may not at first seem like close agreement. But, consider that the reservoir was not produced to absolute depletion—only until it loaded up and died against 450-psi. line pressure.

Most important, the reservoir-limit test predicted that the 7,200-ft. reservoir would not be profitable.

Since there were no other prospects than the 7,200-ft. sand to look for in a south offset to Well 2, no offset was drilled. And, doubtless, the operator saved himself $90,000. If the reservoir-limit test had been available for use on Well 2 at the time it was first completed, money spent on dry holes 3 and 4 might also have been saved.

The Symbols Used and What They Mean

b = volume factor for oil, bbl. space per bbl. stock-tank oil
B = volume factor for gas, bbl. space per M.c.f. gas
B.H.F.P. = bottom-hole flowing pressure, psia.
B.H.S.P. = bottom-hole shut-in pressure, psia.
CE = well completion efficiency, (ideal well drawdown)/(actual well drawdown)
D = Darcy constant for 360 radial° flow, U/1.127 (2π) hK, centipoises per darcy-feet
E = effective coefficient of expansion in an oil reservoir, barrels of oil per barrel of in-place oil per psi.
E_g = effective coefficient of expansion in a gas reservoir, M.c.f. of gas per M.c.f. of in-place gas per psi.
f = porosity, fraction
h = feet of pay completed in a test well
I = reservoir temperature, °R.
K = effective permeability to oil or gas, darcy
N = barrels oil or M.c.f. gas connected to a well completion
p = pressure drawdown in a well, psi.
p_a = average pressure drawdown in a reservoir, psi.
p_T = dimensional pressure drawdown for a well
P = B.H.F.P.
P_i = B.H.F.P. in an ideal well
P_o = B.H.S.P. at the time an RL test is started
q = producing rate, bbl. per day
Q = producing rate, M.c.f. per day
r = radius of well, ft.
R = effective drainage radius, ft.
RL = reservoir limit
S = skin, dimensionless
t = time in days for nonsteady-state flow
T = dimensionless time, $6.328\,Kt/UEf\,(1-W)\,r^2$
U = viscosity, cp.
W = interstitial water, fraction of porosity
Y = daily rate of change of the B.H.F.P. per reservoir barrel per day producing rate for nonsteady-state flow, psi. per bbl.
Y_s = a constant rate of decrease of the B.H.F.P. per reservoir barrel per day producing rate for steady-state flow in a closed reservoir, psi. per bbl.
Z = compressibility factor for a gas

1. Steady-state flow of oil by displacement.
2. Steady-state flow of oil by expansion.
3. Nonsteady-state flow of oil, rate case.
4. The constant-rate RL test for an oil well.
5. Unloading wells, psi. per cycle and number of cycles.
6. Pressure buildup in an oil well.
7. The constant-rate RL test for a gas well.
8. Pressure buildup in a gas well.

Pressure change is key . . . The rate of pressure change in a well per unit producing rate is called a noise or tone.* The special quality:

$$Y = D/2t \qquad (1)$$

is the tone when either an oil or a gas well produces at a constant rate under nonsteady-state flow conditions. The symbol Y denotes the rate of pressure change in psi. per day per reservoir barrel per day producing rate. The time t is in days. The Darcy constant D is:

$$D = 2tY = 0.1412U/hK \qquad (2)$$

The effective capacity in darcy-feet at the time t is:

$$hK = 0.1412U/2tK \qquad (3)$$

when the viscosity of the reservoir oil or reservoir gas is U cp. The effective permeability K at the time t is hK divided by the feet of pay h completed in a well.

The pure tone defined by Equation 1 prevails when a constant producing rate under nonsteady-state flow conditions is the only cause of decreasing the bottom-hole flowing pressure.

The other pure tone has the special quality:

$$Y_s = 1/b_o\,EN \qquad (4)$$

or

$$Y_s = 1/B_o\,E_g\,N \qquad (5)$$

where b and B are volume factors for oil or gas, respectively, E and E_g are coefficients of expansion for oil and gas, respectively, and N is the volume of oil and gas connected to a well. See list of symbols for complete definition.

These equations are for a constant rate of production under steady-state flow conditions in a closed undersaturated oil reservoir or a closed gas reservoir. This tone prevails when a constant producing rate under steady-state flow conditions is the only cause of decreasing the bottom-hole flowing pressure.

The 45° sloping lines in Fig. 1 are solutions of Equation 1. Log Y is plotted against log t. The position of the Y line for a well depends on the effective Darcy constant. According to Equation 2 the Darcy constant varies directly with the viscosity of the flowing fluid and inversely with the effective capacity of the connected pay.

The horizontal line is a solution of Equation 4 or 5 for Y_s is equal to 0.05. The volume factor in barrels of reservoir space per M.c.f. of gas initially connected to a well is:

$$B_o = \frac{5.03\ IZ_o}{P_o} \qquad (6)$$

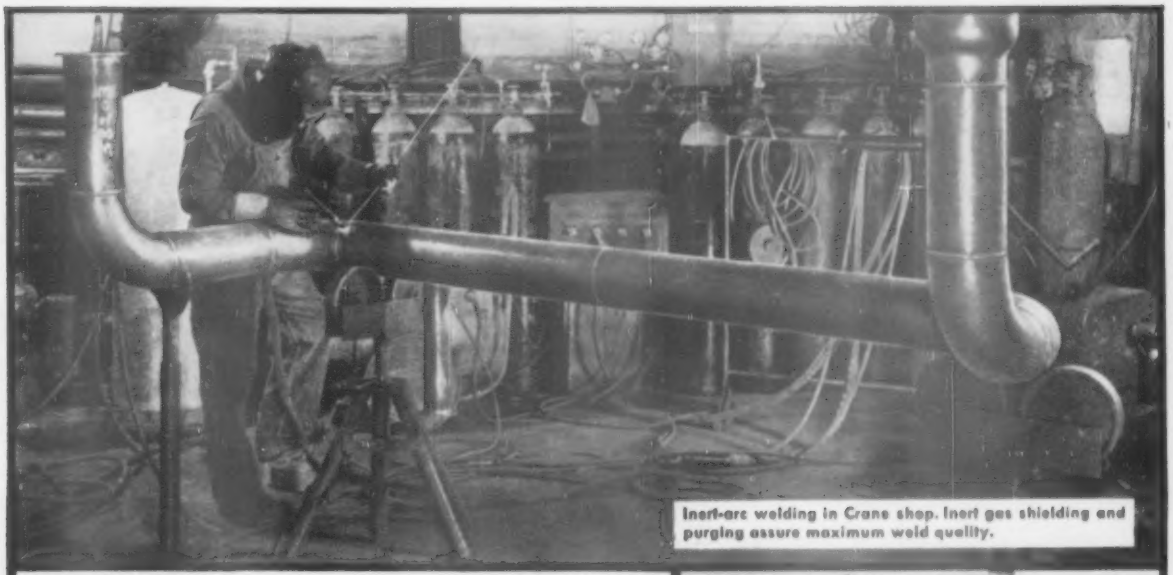
For a given reservoir volume of hydrocarbons and equal producing rates in reservoir barrels per day, the Y_s level for a gas well would be much lower than that for an oil well.

Transition period . . . The dashed curve represents the transition from nonsteady to steady-state flow. The average pressure drawdown in a reservoir for nonsteady-state flow is less than that for a steady-state. A steady-state flow in a closed reservoir means that the pressure drawdown in the well is constant when the producing rate is constant and that the rate of pressure decline in the well, at the external boundaries and for all points between is the same.

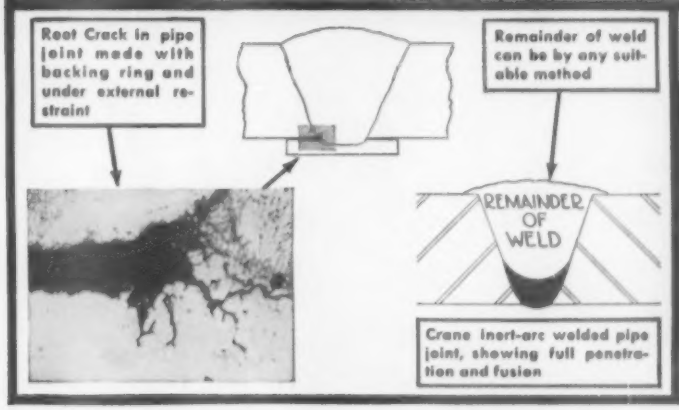
Duration of the transition from a sloping line to its corresponding horizontal line depends on several factors. In general, the larger closed reservoir has a longer period of nonsteady-state flow and a greater transition time interval when things other than the size of a reservoir are equal.

Tones will change . . . Noises other than the tone defined by Equation 1 are present in oil and gas wells. Fig. 2 is for a condensate well in Texas. If 45° lines are passed through the points, it will be seen that the Darcy constant

*The terms noise and tone are author's nomenclature for symbol Y.



Inert-arc welding in Crane shop. Inert gas shielding and purging assure maximum weld quality.


Root Crack in pipe joint made with backing ring and under external restraint
Remainder of weld can be by any suitable method
REMAINDER OF WELD

Crane inert-arc welded pipe joint, showing full penetration and fusion

Typical Crane unit fabrication—Loop header with 17 valves.

Crane-developed butt-welding technique assures more efficient process piping

Gives important advantages—eliminates backing rings

On shop fabricated assemblies, Crane inert-arc *first pass* welded butt joints are making significant contributions to modern process plant operation.

By eliminating backing rings as used with metal-arc welding, the Crane inert-arc first pass technique assures a high quality weld with smooth root contour without crevices and eliminates the possibility of basal cracks sometimes associated with backing rings or the characteristics of the base material.

The practicability and dependability of Crane inert-arc *first pass* welding have been thoroughly demonstrated. Leading process plants have been enjoying its advantages for several years. One installation involved many carloads of alloy fabrication in which all welds were inert-arc type.

Welding all types of stainless, nickel, Monel, Hastelloy "B" and other alloy piping is just one of Crane's services to the process industries. Crane handles every phase of unit fabrication for manifolds, assemblies and valve groupings—simple or complex, large or small. Your local Crane Representative can give you valuable assistance on all your process piping needs—or, write Crane at the address given below. No obligation.

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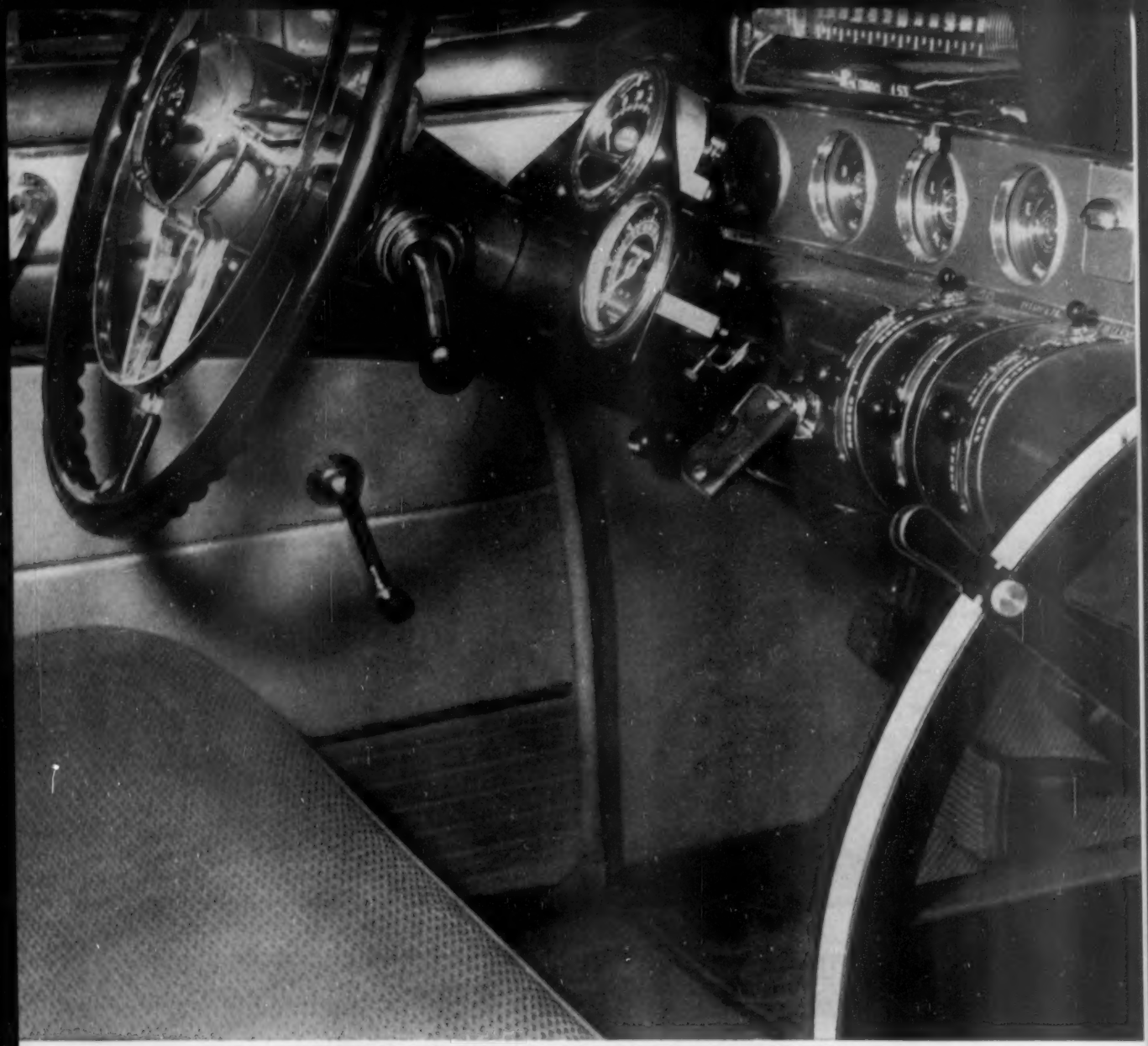

Above, test car with minimum instrumentation needed for fuel rating.

How Ethyl Research equips a car for accurate fuel ratings

Ethyl Research has for years been active in developing more accurate and economical ways of obtaining fuel ratings on the road—offering refiners convenient methods for evaluating their gasoline stocks.

At Ethyl Laboratories, we have found that the various road rating procedures can be adequately handled by a grouping of just five instruments, some of which can be seen in the picture above. But we have discovered that the addition of other key equipment (see right-hand page) can facilitate your road testing operations.

Our people have accumulated hundreds of thousands of miles of road testing experience with this equipment. If you would like more

Right, equipment suggested for more complete test-car setup.

information about this subject, please contact your Ethyl technical representative.

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ETHYL CORPORATION
New York 17, N. Y.
Research Laboratories:
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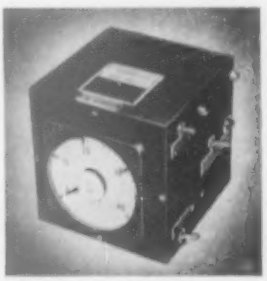
2600 Cajon Road, San Bernardino, Calif.

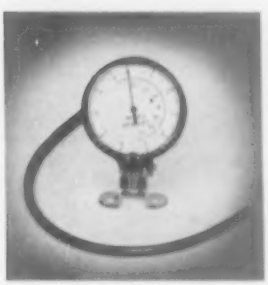
Electronic spark protractor provides an accurate method for continuous indication of spark advance. It gives direct readings at all speeds.

Timing light (above), calibrated flywheel and sight tube are used for obtaining instantaneous spark advance position. Flywheel is marked in crankshaft degrees.

Auxiliary fuel system facilitates testing of several fuels in succession. Simple coupling connects the auxiliary line to the inlet side of the fuel pump.



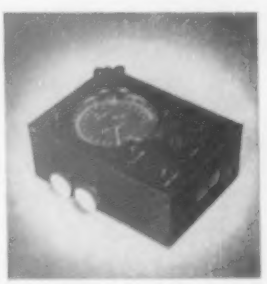
Tachometers are accurate mechanisms for measuring the engine speed. They are adaptable for operation with any six- or twelve-volt system.



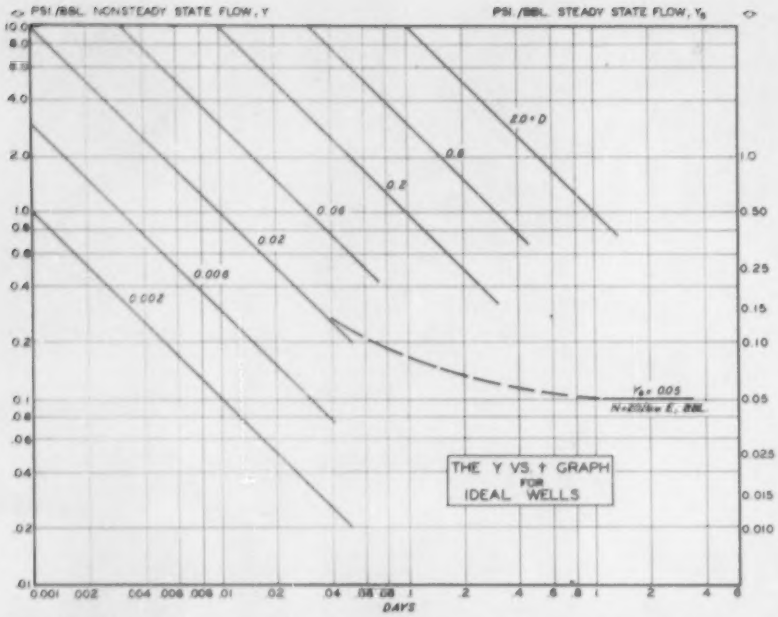
Vacuum gauge is required for part-throttle ratings. At any given car speed, the vacuum gauge permits reproducing part-load conditions.

Selector switches for thermocouples and resistance bulb thermometers are needed to permit reading temperatures at various locations

Thermocouples and resistance bulbs are used to measure the temperatures of the coolant, the lubricating oil, and the air entering the carburetor.



Potentiometer is used to indicate the temperatures measured by the thermocouples. Road ratings require a rugged instrument, insensitive to vibration.



RELATIONSHIP of the ratio of the rate of pressure decline and production rate decline with respect to time of flow. Sloping lines result during transition period and horizontal line marks steady-state. The D parameter is a function of permeability, bed thickness, and fluid viscosity. Fig. 1.

decreased progressively from about 0.32 to 0.036, that is, the effective permeability to gas increased roughly tenfold in about 6 hours.

This well had condensate at the bottom of the tubing and presumably also in the pay around the well. As more and more condensate was displayed, the effective permeability to gas increased progressively. After 12 hours of production, the rate of decrease of the bottom-hole flowing pressure became constant at about 0.045 psi. per day per unit rate of production.

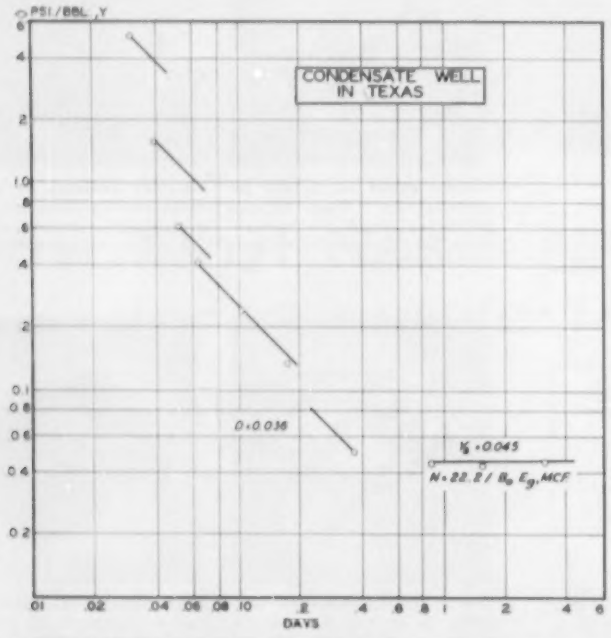
Fig. 3 is for an oil well in Louisiana. The increasing portion of the productive area probably reached fault A in about 30 minutes, fault B in about 100 minutes and fault C in less than 400 minutes. Y_s leveled off at about 0.43 psi. per day per unit rate of production.

The interpretation is that the well is completed in a small graben. The well locates much closer to one of the faults than it does to either one of the other two. The shut-in tubing pressure was much higher than the saturation pressure. This enabled the well to unload in about 2 minutes. The Darcy constant is about 0.048 for the first 10 minutes and about 0.126 after 100 minutes.

Fig. 4 is for an oil well in Texas. Some of the top perforations are opposite a primary gas cap. However, most of the perforations are in oil. The pressure bomb was in gas all the way to the bottom of the tubing. The well produced gas only for about an hour. No Y data could be obtained because of the gas noise. If the initial point is assumed to be a Y value for oil, the effective Darcy constant at the end of 178 minutes of production is 0.084. Y_s became constant at about 0.128 psi. per day per unit producing rate.

Fig. 5 is for a gas well in California. This well is completed entirely in gas but its location is believed to be close to a gas-water contact. When the increasing portion of the drainage area is entirely in water, the rate of pressure change per unit rate of production increases.

The shifting to the right of the noise data may have been caused partly by the impermeable updip productive limit and partly by the downdip productive limit which is believed to be water. If the initial point is assumed to be a Y value for gas, the effective Darcy constant is 0.00086 at the end of 100 minutes of production. As no Y_s data were available, a buildup was run after the well produced 2,022 minutes.

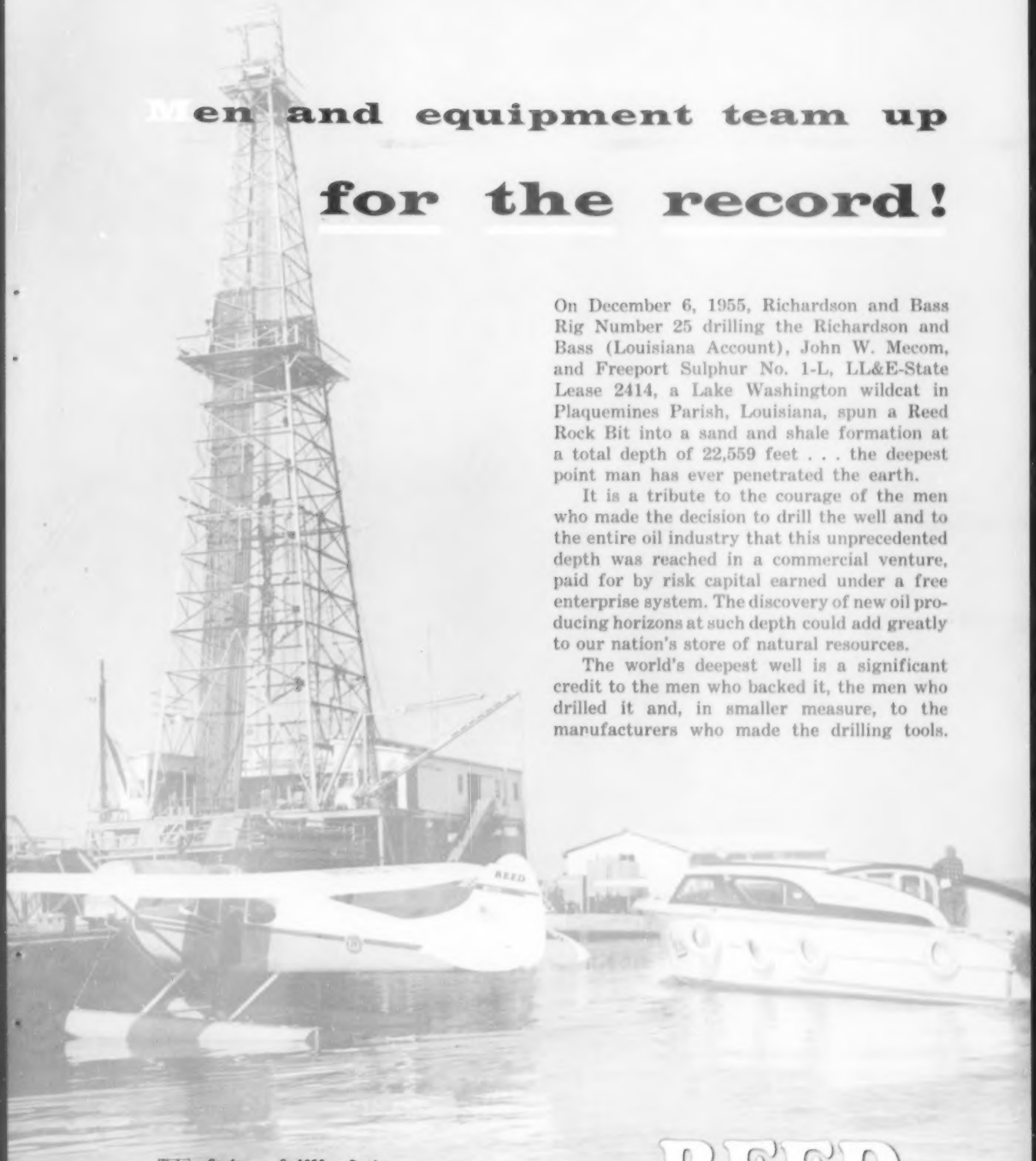


CHANGING DARCY CONSTANT indicates gradual increase of permeability to gas in this well. Steady-state Y value determines volume of gas when volume factor and coefficient of expansion are known. Fig. 2.

Classification of noises . . . A noise may be classified according to its origin. The first noise detected in any well is that due to the unloading of the well. The time required to stabilize the distribution of the flowing pressure in the tubing varies greatly among wells. Some gas wells, and the oil wells for which the shut-in tubing pressure at the surface is much greater than the saturation pressure for the oil, may stabilize within a few minutes after the RL test is started. The period of stabilization of other oil wells may be on the order of hours or greater. (Note: See account of field measurement of this noise at end of article.)

Men and equipment team up

for the record!



On December 6, 1955, Richardson and Bass Rig Number 25 drilling the Richardson and Bass (Louisiana Account), John W. Mecom, and Freeport Sulphur No. 1-L, LL&E-State Lease 2414, a Lake Washington wildcat in Plaquemines Parish, Louisiana, spun a Reed Rock Bit into a sand and shale formation at a total depth of 22,559 feet . . . the deepest point man has ever penetrated the earth.

It is a tribute to the courage of the men who made the decision to drill the well and to the entire oil industry that this unprecedented depth was reached in a commercial venture, paid for by risk capital earned under a free enterprise system. The discovery of new oil producing horizons at such depth could add greatly to our nation's store of natural resources.

The world's deepest well is a significant credit to the men who backed it, the men who drilled it and, in smaller measure, to the manufacturers who made the drilling tools.

(Note) On January 8, 1956, a Reed Rock Bit was used to deepen the hole eleven feet to a total depth of 22,570 feet.

REED

ROLLER BIT COMPANY

HOUSTON 1, TEXAS

NEW YORK LONDON BUENOS AIRES

Richardson and Bass crews

drill world's de

using Reed Rock Bits

On the page opposite are pictured the handful of men whose skill and ingenuity in handling rotary oilwell drilling tools enabled them to drill the world's deepest well. With Richardson and Bass Rig 25 they drilled 22,559 feet into the earth without making the slightest error which could have resulted in serious trouble or loss of the hole.

73 REED ROCK BITS USED

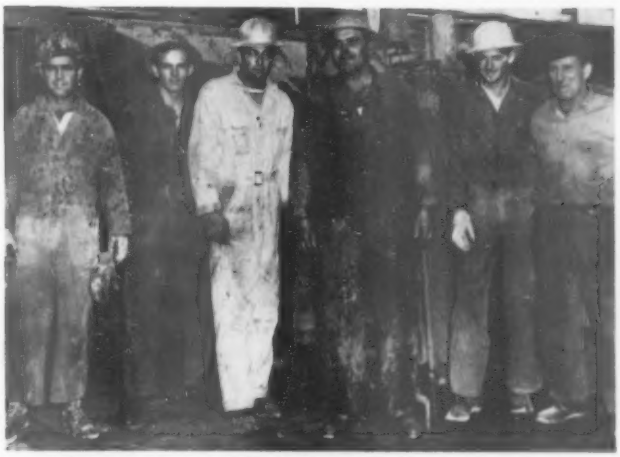
Shown below are the last five used from 22,027 feet to 22,559 feet. Sixty-three Reed cross roller Rock Bits were used below 14,000 feet. (See complete bit record on next page.) Three Reed Drill Collars were used in the drill string.

(Note) On January 8, 1956, a Reed Rock Bit was used to deepen the hole eleven feet to a total depth of 22,570 feet.

REED

epest well

most of the way!



Crew, Rig 25, left to right: F. A. Mobley, helper; M. J. Gondrella, derrickman; J. E. Steinwinder, driller; E. N. Steele, Jr., helper; B. S. Whitfield, helper; W. C. Jackson, fireman.

G. G. "Pinky" Jordan, toolpusher, a veteran Richardson and Bass hand whose job it was to keep Rig 25 "drilling ahead" on the record-setting well.

Rex Haile, left, and Bill Kenny, right, Richardson and Bass mud engineers who were on duty alternately each day Rig 25 was drilling the world-record well.

(Above) Crew, Rig 25, left to right: L. J. Breaux, derrickman; T. V. Wallace, fireman; Billy Van Winkle, driller; E. W. Warrick, helper; R. D. Mark, helper; S. E. Ellington, helper.

(Right) Crew, Rig 25, left to right: M. B. McDaniel, welder; T. A. Hambrice, helper; George Fruge, fireman; L. J. Seneca, derrickman; C. V. Peeler, helper; H. D. Wright, driller; R. C. Wright, helper.

Shown above are three 4½-inch O. D. Reed Drill Collars used in the drill string on Rig 25 while drilling the world's deepest well.

ROLLER BIT COMPANY

HOUSTON 1, TEXAS

The record speaks for itself!

FORM Bp. 10-101
1/1/53

SPUDDED: 2-27-55
UNDER SURFACE: 3-8-55
INTER: 9-16-55
22,559': 12-6-55

A.P.I. BIT QUESTIONAIRE

Oil Company RICHARDSON & BASS (Gla. Acct) Well LA LAND & EXPLORATION #1-L Contractor SAME RIG #25

Date Spudded FEB. 27, 1955 Field ~~PROPER~~ LAKE WASHINGTON WILDCAT County PLAQUEMINE State LA.

Drill Pipe O.D. _____ Tool Joint Type _____

Type Rig - Steam ✓ or Power _____ Mud Type LIME BASE OIL EMULSION 10% OIL

Drill Collars { Length 90' O.D. 8" I.D. _____ Interval 0-13665
Length 90' O.D. 5 3/4" 4 1/8" I.D. _____ Interval 13665-19752, 19752-22559

5 LUCEY 150 BOILERS STEAM PRESS. - 350 PSI

TOOL PUSHER -

Observed Data

Bit No.	Bit Size	Bit Mfgr.	Bit Type	Jet-y Reg'd	Watercourses No.	Watercourses Size	Depth Out	Footage	Hours Drld.	Feet per Hour	Bit Weight 1000 #	Table RPM	Mud Wt.	Mud Vis.	Deviation	Pump No. Liner	Pump No. SPM	Pump No. GPM	Pump No. Liner	Pump No. SPM	Pump No. GPM	Pump * Operation	Pump Press.	Total GPM	Nozzle Vel.
1	26	HUNT	3-WAY				300																		
2	12 1/4	HTC	OSC-3	J			3007	2707	11 3/4																
3	17 1/2	REED	2-CTTE	D																			1600		

Observed Data

Bit No.	Bit Size	Bit Mfgr.	Bit Type	Jet-y Reg'd	Watercourses No.	Watercourses Size	Depth Out	Footage	Hours Drld.	Feet per Hour	Bit Weight
41	12 1/4	REED	LT 3	J	2	3/4	12917	104	18 3/4		
42	✓	HTC	OSC-3	J			13032	115	19 1/4		
43	✓	✓	✓	✓			13189	157	16		
44	✓	✓	✓	✓			13326	137	16 3/4		
45	✓	✓	✓	✓			13584	258	26 1/4		
46	✓	✓	✓	✓			13665	81	12		
47	✓	✓	✓	✓	RERUN		13665				CIRC
48	8 3/8	REED	T	✓	2	3/4	RERUN				DRIL
49	✓	✓	✓	✓	✓	✓					TRIP
50	✓	✓	✓	✓	✓	✓	13838	173	25 3/4		
51	✓	HTC	OSC-3	✓			14049	211	27 3/4		
52	✓	REED	T	✓	2	3/4	14366	317	40 1/2		
53	✓	✓	✓	✓	✓	✓	14562	196	26		
54	✓	✓	✓	✓	✓	✓	14842	280	40		
55	✓	✓	✓	✓	✓	✓	15064	222	38 1/2		
56	✓	✓	✓	✓	✓	✓	15265	201	37 3/4		
57	✓	✓	✓	✓	✓	✓	15482	217	36 1/2		
58	✓	✓	✓	✓	✓	✓	15709	227	38		
59	✓	✓	✓	✓	✓	✓	15985	276	45		
60	✓	✓	✓	✓	✓	✓	16197	212	38		
61	✓	✓	✓	✓	✓	✓	16422	225	38 3/4		
62	✓	✓	✓	✓	✓	✓	16638	216	35 1/2		
63	✓	✓	2HM	✓	✓	✓	16763	125	23 1/2		
64	✓	✓	2HM-1	✓	✓	✓	16959	196	34 1/2		
65	✓	✓	2HM	✓	✓	✓	17116	157	27 1/2		
66	✓	✓	✓	✓	✓	✓	17306	190	35 1/2		
67	✓	✓	✓	✓	✓	✓	17427	111	23 1/2		
68	✓	✓	2HM-1	✓	✓	✓	17567	135	25 1/2		
69	✓	✓	✓	✓	✓	✓	17677	110	19		
70	✓	✓	✓	✓	✓	✓	17791	114	20 1/4		
71	✓	✓	✓	✓	✓	✓	17900	109	22 3/4		
72	✓	✓	✓	✓	✓	✓	18075	175	33		
73	✓	✓	✓	✓	✓	✓	18265	190	32 1/2		
74	✓	✓	✓	✓	✓	✓	18466	201	38		
75	✓	✓	✓	✓	✓	✓	18606	140	27 1/2		
76	✓	✓	✓	✓	✓	✓	18705	99	21 3/4		
77	✓	✓	✓	✓	✓	✓	18935	230	47		
78	✓	✓	✓	✓	✓	✓	19116	181	46 1/2		
79	✓	✓	✓	✓	✓	✓	19343	227	42 3/4		
80	✓	✓	✓	✓	✓	✓	19556	207	38 1/2		

* Pump Operation: S - Single; P - Parallel; C - Compound;
** Hydraulic HP based on 65% Efficiency.

Observed Data

Bit No.	Bit Size	Bit Mfgr.	Bit Type	Jet-y Reg'd	Watercourses No.	Watercourses Size	Depth Out	Footage	Hours Drld.	Feet per Hour	Bit Weight
81	8 3/8	REED	2HS-1	J	2	3/4	19743	193	38		
82	✓	✓	✓	✓	✓	✓	19752	9	2		RERUN
83	6	✓	2C	R			17422	1444	30		
84	✓	✓	✓	✓			18237	1415	30		DRILLIN
85	✓	✓	T	✓			19690	853	20 1/2		CEMEN
86	✓	✓	2C	✓							
87	✓	✓	✓	✓	DRILLING UP PACKERS, CONDITIONING HOLE ETC						
88	✓	✓	✓	✓							
89	✓	✓	✓	✓							
90	✓	HTC	OWS	✓			19732	47	9 3/4		
91	✓	REED	2C	✓			19865	125	25 1/4		
92	✓	✓	✓	✓			20071	166	33		
93	✓	✓	✓	✓			20188	117	26		
94	✓	✓	✓	✓			20291	103	26 1/2		
95	✓	✓	✓	✓			20415	124	30		
96	✓	✓	✓	✓			20515	100	23 1/2		
97	✓	✓	✓	✓			20579	64	21		
98	✓	✓	✓	✓			20656	77	23		
99	✓	✓	✓	✓			20692	36	14 3/4		
100	5 7/8	HTC	W7R	✓	CHRISTENSEN CORE BIT		20729	37	15		
101	5 7/8	CHRISTENSEN	CORE BIT				20753	24			
102	✓	✓	✓	✓	✓	✓	20757	4			
103	6	REED	2C	R			20778	21	8		
104	5 7/8	CORE BIT					20791	13	12		
105	6	REED	2C	R			20814	23	13		
106	✓	✓	✓	✓			20849	35	23		
107	✓	✓	✓	✓			20900	51	27		
108	✓	✓	✓	✓			20956	56	28		
109	✓	✓	✓	✓			20992	36	19 1/2		
110	✓	✓	✓	✓			21018	26	16		
111	✓	✓	✓	✓			21085	67	29		
112	✓	✓	✓	✓			21183	98	36		
113	✓	✓	✓	✓			21234	51	18 1/2		
114	✓	✓	✓	✓			21253	17	16 1/2		
115	✓	✓	✓	✓			21336	83	30		
116	✓	✓	✓	✓			21407	71	30		
117	✓	✓	✓	✓			21463	56	27 1/2		
118	✓	HTC	W7R	✓			21506	43	19		
119	✓	REED	2C	✓			21603	99	35 3/4		
120	✓	✓	✓	✓			21703	98	33 1/2		

* Pump Operation: S - Single; P - Parallel;
** Hydraulic HP Based

Observed Data

Bit No.	Bit Size	Bit Mfgr.	Bit Type	Jet-y Reg'd	Watercourses No.	Watercourses Size	Depth Out	Footage	Hours Drld.	Feet per Hour	Bit Weight	Table RPM	Mud Wt.	Mud Vis.
121	6	REED	2C	R			21806	103	36				18.1	70
122	✓	✓	✓	✓			21920	116	42					
123	✓	✓	✓	✓			22027	107	36					
124	✓	✓	✓	✓			22127	100	38 1/4					
125	✓	✓	✓	✓			22249	122	48				18.6	66
126	✓	✓	✓	✓			22350	101	37				18.6	66
127	✓	✓	✓	✓			22447	97	37 1/2					
128	✓	✓	✓	✓			22559	112	41 3/4			Reached	12-6-	

REED
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COMPANY
HOUSTON 1, TEXAS
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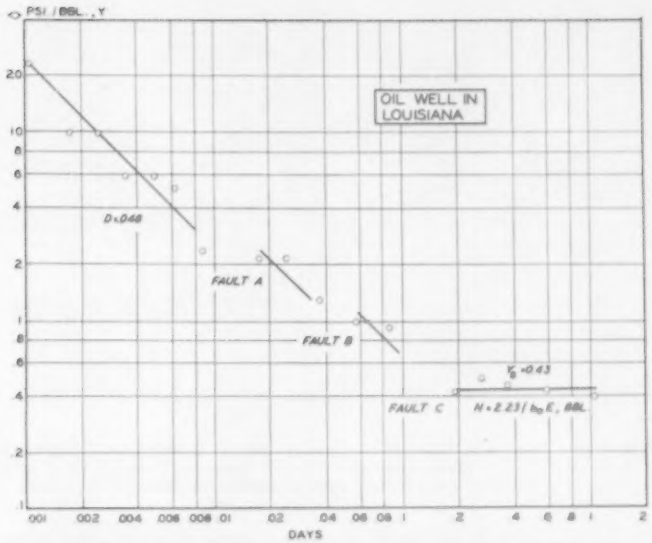


PRESSURE PERFORMANCE of this well indicates close contact with three faults. Pressure decline tends to level out as each boundary is reached. Total oil in place is determined from Y_0 value. Fig. 3.

The mud noise is that due to the unplastering of additional perforations and/or that due to the production of mud. Mud noises can be minimized by producing a well fast enough and long enough before the RL test is started. For the purpose of this paper it is assumed that the mud noise is negligible.

The noises caused by external boundaries may be summarized as follows: The Hurst-van Everdingen equation[1 4 5] for a constant rate of production under nonsteady-state flow condition is:

$$P_o - P = bDq \times (\tfrac{1}{2} \ln T + 0.4045 + S) \quad (7)$$

for an oil well or:

$$P_o^2 - P^2 = 2(5.03)\,DIQZ \times (\tfrac{1}{2} \ln T + 0.4045 + S) \quad (8)$$

for a gas well. The dimensionless time T is:

$$T = \frac{6.328\,Kt}{UEf\,(1 - W)\,r^2} \quad (9)$$

As the increasing portion of the drainage area approaches an impermeable boundary, the effective capacity hK may decrease due to either a lesser pay thickness or permeability in the vicinity of the external boundary. This increases the Darcy constant. The Y data are shifted to the right on the Y vs. t graph. After an impermeable boundary is reached, a portion of the flow is through less than 360°. This also tends to shift Y data to the right. If the Darcy constant increases while the well is unloading, the Y shift may not be evident from the recorded bottom-hole flowing pressure data.

The noise caused by a gas-oil, oil-water, or a gas-water contact may shift the Y data either to the right or left on the Y vs. t graph. When the increasing portion of the drainage area advances into a more viscous fluid, as from gas into water, the Darcy constant increases, Y shifts to right. An advancement from oil into a primary gas cap tends to shift Y to the left.

Effective Coefficient of Expansion

The barrels of oil available per psi. drawdown on N barrels of connected oil is EN where:

$$E = E_o + \frac{1}{1 - W}(WE_w + E_r) \quad (10)$$

The expansion E_o for a reservoir oil is measured in a laboratory. For water expansion E_w, the writer uses 4×10^{-6} per psi.

Compaction pressure is equal to the difference between the pressure exerted by the overburden and the reservoir pressure. A reduction in reservoir pressure increases the compaction pressure. The latter reduces porosity. The effect of a porosity reduction E_r is given in the paper by Hall.[3] When E_r is taken at 4×10^{-6} per psi. Equation 10 may be written as:

$$E = E_o + \frac{1 + W}{1 - W} \times \frac{4}{10^6} \quad (11)$$

The E thusly defined is used for oil reservoirs.

For a gas:

$$P_o V = Z_o RI$$

from which:

$$E_g = -\frac{dV}{Vd\,P_o} = \frac{1}{P_o} - \frac{dZ_o}{Z_o\,dP_o} \quad (12)$$

where E_g is the effective coefficient of expansion for no decline in reservoir pressure. For an ideal gas and also for actual gases in the pressure range where dZ/dP is on the order of zero, E_g is equal to 1/P. The last term in Equation 12 is a correction which is more than $1/2P_o$ in some high-pressure condensate reservoirs. The value of E_g, either measured in a laboratory or calculated from P and Z data, is used for gas and condensate reservoirs directly, that is, E_w and E_r are neglected because E_g is comparatively high for the usual gas well. However, when the reservoir pressure and temperature are close to the critical pressure and temperature for the in-place hydrocarbons, Equation 11 is used.

Table 1 shows a gas for which E_g is only 0.424 times 1/P at 250° F. and 11,715 psia. The separator yield from this gas is 20 bbl. per M.M.c.f.

TABLE 1—EFFECTIVE COEFFICIENT OF EXPANSION FOR A GAS

Thousand psia., P	Z	$10^6/P$	$10^6\,E_g$
1	0.955	1,000	1,038
2	0.927	500	514
3	0.934	333	309
4	0.968	250	204
5	1.025	200	138
6	1.089	167	103
7	1.161	143	78.3
8	1.236	125	64.3
9	1.314	111	53.3
10	1.394	100	45.5
11	1.472	90.9	39.3
11.715	1.525	85.4	36.2

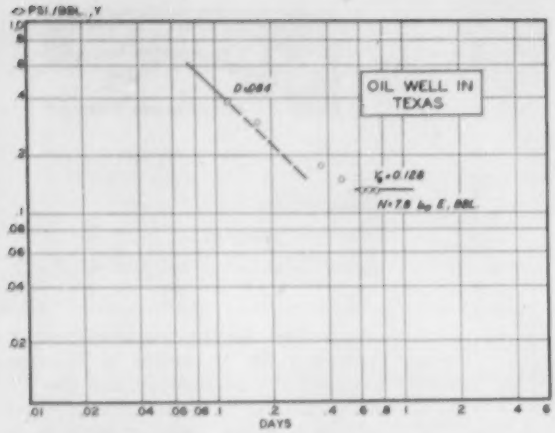
Barrels of oil or cubic feet of gas . . . The barrels of oil:

$$N = \frac{5.03\,t}{b_o\,DE} = \frac{5.03}{2b_o\,EY} \quad (13)$$

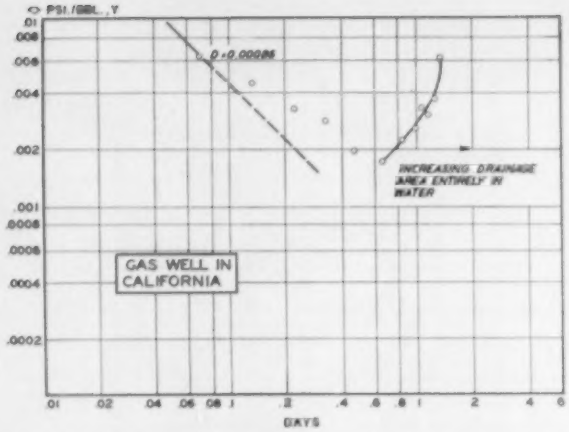
is estimated to be connected with a well completion at the time a constant-rate RL test is started in order to have a nonsteady-state flow for t days. If a steady-state flow is established, N is equal to $1/b_o EY_s$.

The estimated M.c.f. of well-connected gas is:

$$N = \frac{503\,t}{B_o\,E_g\,D} = \frac{P_o\,t}{E_g\,DIZ_o}$$



INITIAL GAS PRODUCTION along with the oil affected the transition-period Y values in this well. However, the steady-state Y value can still be used to find the oil connected to the well. Fig. 4.



THIS WELL is completed in gas but is located near a gas-water contact which causes the latter Y values to increase. Here, as in most cases, the reservoir limit is reached in about a day's time. Fig. 5.

$$= \frac{P_o}{2E_g IYZ_o} \quad (14)$$

at the end of t days of nonsteady-state flow. If a steady-state flow is established:

$$N = \frac{I}{B_o E_g Y_s} = \frac{P_o}{5.03\, E_g IY_s Z_o} \quad (15)$$

The Rate of Pickup

The rate of detecting the reservoir of oil in the ground in barrels per day:

$$\frac{dN}{dt} = \frac{5.03}{b_o DE} = \frac{35.6\, hK}{Ub_o E} \quad (16)$$

shows that the rate of pickup is independent of the producing rate. Hence, the skin effect[4,5] has no influence on the rate of pickup if the well is thoroughly cleaned before the RL test is started. For the following conditions: h = 10 ft.; K = 0.1 darcy; U = 1 cp.; and $b_o E = 17.8 \times 10^{-6}$ per psi., the estimated pickup is at the rate 2,000,000 bbl. per day during the time a well is producing under nonsteady-state flow conditions without interference from external boundaries.

For a gas reservoir:

$$\frac{dN}{dt} = \frac{7.08\, hKP_o}{UE_g IZ_o} \quad (17)$$

when h = 10 ft.; K = 0.1 darcy; U = 0.02 cp.; P_o = 4,000 psia.; $E_g = 200 \times 10^{-6}$ per psi.; I = 248° F. + 460 = 708° R., and Z_o = 1, the estimated gas pickup is at the rate of 10,000,000 M.c.f. per day while the nonsteady-state flow condition prevails without interference from external boundaries.

Well-Completion Efficiency

The well completion efficiency is:

$$CE = \frac{P_o - P_i}{P_o - P} \quad (18)$$

where $(P_o - P_i)$ is defined by Equation 7 or 8 when S is equal to zero. Section 5 in the Appendix discusses the well-completion efficiency. The subscript i refers to an ideal well, that is, one for which S = 0.

Pressure buildup . . . The pressure buildup[4,5,6] should be included with the RL test on any well for which the Y tone is not evident due to either the noise caused while the well is unloading or the din from the gas-oil, oil-water, or gas-water contact. This procedure minimizes the possibility of including some gas or water for in-place oil or some oil or water for in-place gas. The buildup may show a pressure decline in a small accumulation of hydrocarbons underlain by water.

The pressure drawdown in an ideal well at the time Δt days since shut in is:

$$P_o - P(\Delta t) = \frac{0.1625\, Ubq}{hK} \log \frac{t + \Delta t}{\Delta t} \quad (19)$$

A plot of the bottom-hole shut-in pressure P (Δt) against log Δt/(t + Δt) is a straight line on semilog paper. When a small volume of oil or gas is underlain by a large volume of water, the bottom-hole shut-in pressure (B.H.S.P.) obtained by extrapolation of the buildup data may be less than the bottom-hole pressure at the time the RL test is started. However, the B.H.S.P. thus obtained is higher than it would be if there were no water influx into the reservoir space initially occupied by the hydrocarbons. (See Section 6 in the appendix.)

(Note: A recently tested discovery well deep off the flank of Barbers Hill salt dome, Liberty County, Texas, demonstrated the noise of unloading when put on production. A new-type highly sensitive, surface-recording, electronic bottom-hole pressure bomb picked up the shock noises of passing trash as the trash went through the surface choke on the well. The duration of time was only a few seconds, but the noise was clearly evident from the recorded bottom-hole pressure chart.)

Acknowledgment

The assistance of R. F. Lemon, of El Paso Natural Gas Co., Houston, in the preparation of this paper is gratefully acknowledged.

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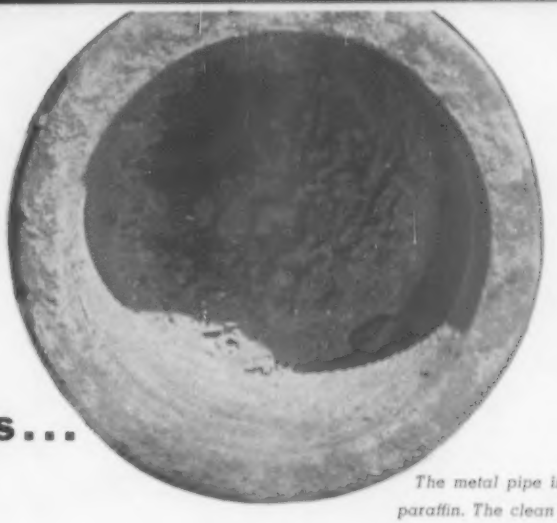
When metal pipe looks like this...



The metal pipe is almost completely clogged with paraffin. The clean Tenite Butyrate pipe has been in service for months on a high-paraffin oil line. (Paraffin accumulated only on the steel pipe connector.)

TENITE BUTYRATE looks like this...

BECAUSE of the extra-smooth walls of pipe made of Tenite Butyrate plastic, the problem of paraffin accumulation when carrying high-paraffin crudes is often completely eliminated.

In addition, Tenite Butyrate does not corrode. It is used successfully in low-pressure lines carrying sour crudes and salt water. It is also unaffected by electrolytic action. As a result, under many conditions which cause metal pipe to clog or leak, Tenite Butyrate continues to give trouble-free service.

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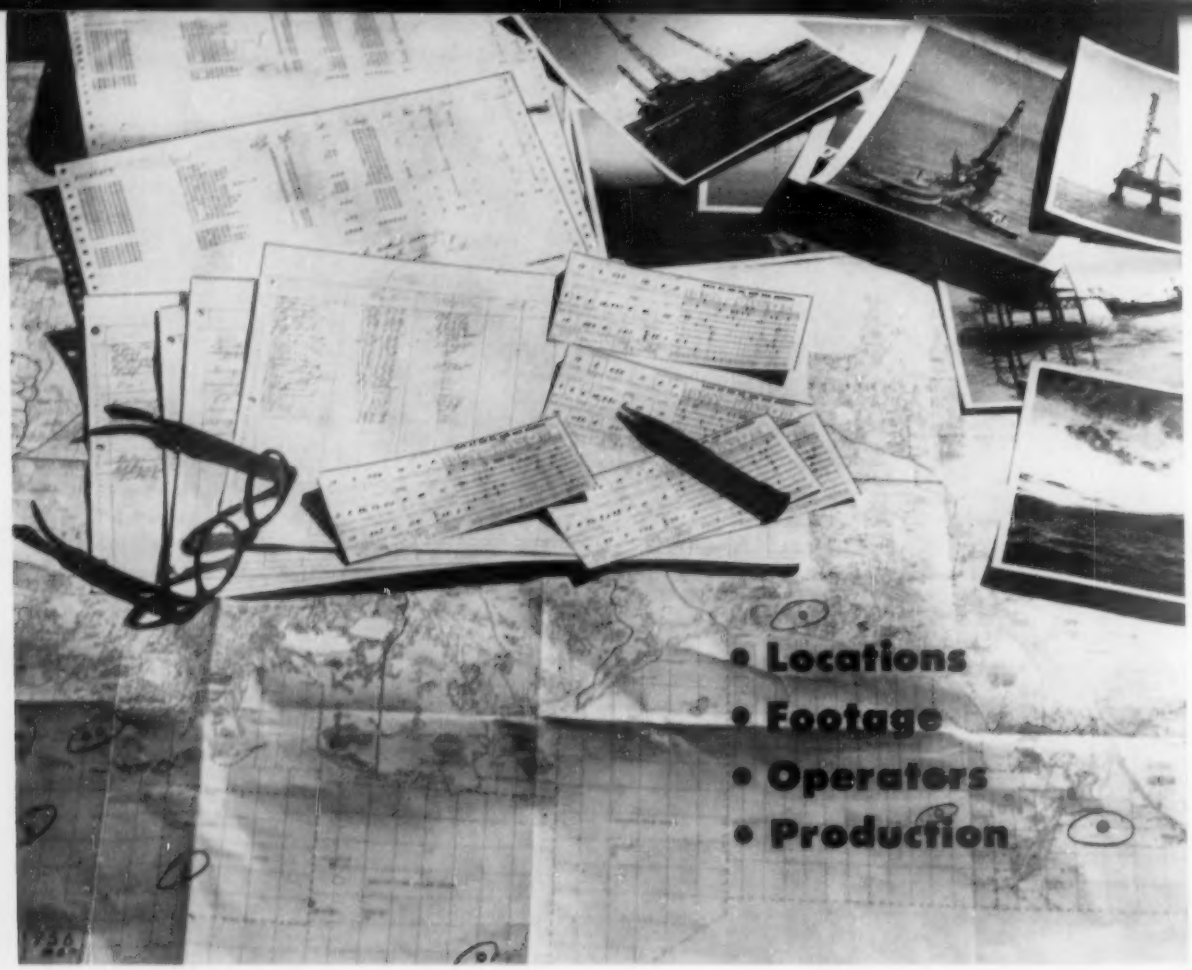
We will be glad to give you the names of companies that produce pipe and a complete range of fittings made of Tenite Butyrate, as well as additional information about this Eastman plastic. Write EASTMAN CHEMICAL PRODUCTS, INC., subsidiary of Eastman Kodak Company, KINGSPORT, TENNESSEE.

A 16-mm. sound-color film, "PLASTIC PIPELINES," is available upon request.

TENITE
BUTYRATE
an Eastman plastic



Journal's experimental punch-card-system survey shows that . . .

Louisiana's Success Ratio Hits 67.6 Per Cent

by Neil Williams
Associate Editor

SOUTH LOUISIANA remains one of the country's most fertile hunting grounds for additional petroleum reserves.

• Active and widespread exploration carried on over the region almost continuously for many years back does not appear to have lessened its attractiveness for further exploitation.

• Its impressive array of oil and gas fields already uncovered, and prolific productivity and extensive reserves so far established, do not seem to have exhausted by any means the area's potentialities for new development.

These are conclusions reached in a survey of drilling operations in the area during a recent typical month as recorded in The Oil and Gas Journal's new and experimental electronic punch-card system of handling well reports.

The survey shows the area continues to have an exceptionally high success ratio among wells drilled despite the numerous discoveries already made and productive development so far. Of the 182 wells completed during the month, 123, or 67.6 per cent, proved productive. Success ratio of field-development wells alone, totaling 144, was 75 per cent.

Of the 38 wells listed as wildcats, including major extensions and new-pay tests, 15, or 39.5 per cent, were successful.

A breakdown of the district's "onshore" and "offshore" operations reveals an over-all higher degree of success in drilling on the Continental Shelf area than on the landward side. Wells completed back of the coast line totaled 146, of which 97, or 66.5 per cent, got production. The success ratio of the 36 offshore wells completed was 72.2 per cent.

However, offshore wildcats did not fare so well as those on the landward side of the coast. There were 8 onshore wildcat tests completed, of which 3, or 37.5 per cent, were producers, as compared with 30 onshore wildcat completions with a success ratio of 40 per cent. Field-development wells offshore accounted for a success ratio of 82.1 per cent. Onshore, 73.3 per cent of 116 field-well completions were productive.

Figures on offshore drilling successes are significant in that its vast Continental Shelf areas generally are regarded as South Louisiana's greatest realm of new exploration.

Offshore exploration, delayed many years by federal-state title complications and retarded by preoccupation of would-be operators with easier-to-get and less costly operated onshore sources of supply, has been increasing rapidly the past year and is reaching sizable

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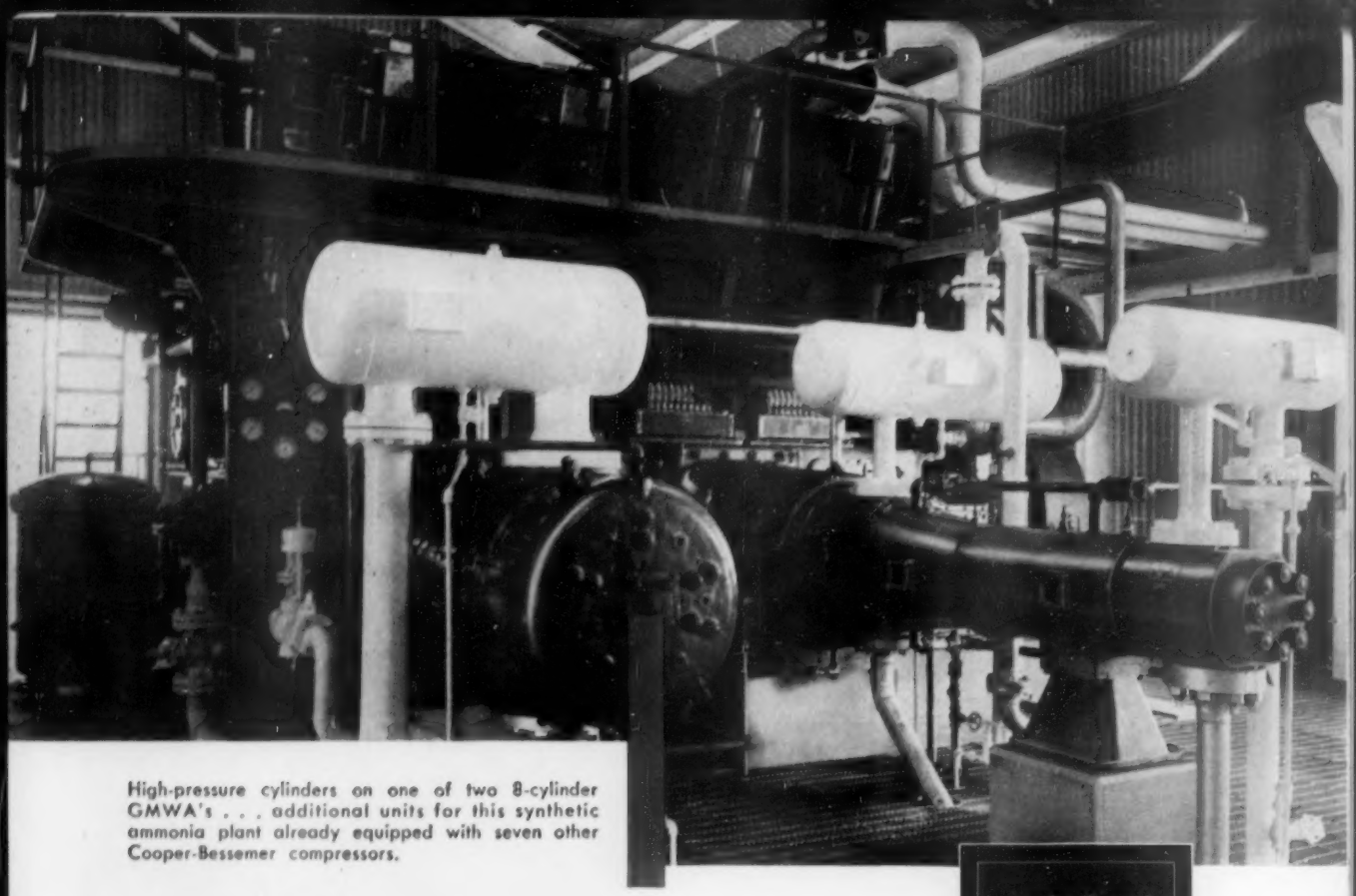

High-pressure cylinders on one of two 8-cylinder GMWA's . . . additional units for this synthetic ammonia plant already equipped with seven other Cooper-Bessemer compressors.

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• When it comes to compressor horsepower, this Texas synthetic ammonia plant has an important advantage in common with scores of other plants throughout this country and abroad . . . they all benefit from the low maintenance, high operating efficiency of Cooper-Bessemer compressors.

The plant shown here, for example, recently added two 2000 hp Cooper-Bessemer GMWA's to meet increased work demands. This one plant now boasts more than 10,000 Cooper-Bessemer horsepower to effectively handle recirculation and the processing of a hydrogen-nitrogen mixture, through five stages, from 2.5 to 5300 psig.

Since Cooper-Bessemers are especially designed to easily handle the most severe work demands, full-time at full-load operation presents no handicap to the smooth service delivered by these work-wise units.

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COMPLETIONS BY COMPANIES

Company—	Completions— Oil-gas cond.	Dry	Total	Per cent of total	Footage	Per cent of total
The Texas Co.	17	4	21	11.5	213,463	11.8
Shell Oil Co.	13	3	16	8.8	152,815	8.5
The California Co.	10	3	13	7.2	117,983	6.5
Humble Oil & Refining Co.	5	5	10	5.5	108,176	6.0
Gulf Refining Co.	7	3	10	5.5	98,688	5.4
Total top 5	52	18	70	38.5	691,125	38.2
Hunt companies	6	2	8	4.4	79,974	4.5
Magnolia Petroleum Co.	7	1	8	4.4	70,134	3.9
Union Oil Co. of California	4	2	6	3.3	55,507	3.1
Pan American Prod. Co.	1	4	5	2.7	68,474	3.8
Sun Oil Co.	4	0	4	2.2	49,697	2.7
Stanolind Oil & Gas Co.	4	0	4	2.2	26,383	1.4
Total next 6	26	9	35	19.2	350,169	19.4
Total top 11	78	27	105	57.7	1,041,294	57.6
Others	45	32	77	42.3	766,279	42.4
Grand total	123	59	182	100.0	1,807,573	100.0

COMPLETIONS BY PARISHES

Parish—	Wells— Onshore	Offshore	Total	Total footage
Plaquemines	18	20	38	359,383
Lafourche	16	2	18	194,422
Terrebonne	14	3	17	202,843
St. Mary	9	6	15	184,072
Calcasieu	12	0	12	81,860
Cameron	11	1	12	119,425
Jefferson Davis	9	0	9	109,175
Iberia	8	1	9	84,606
Iberville	8	0	8	73,333
Beauregard	8	0	8	65,547
Allen	8	0	8	72,377
Acadia	6	0	6	59,234
Others	19	3	22	201,296
Total	146	36	182	1,807,573

proportions. Relatively, it still is in its infancy, and later may account for a major portion of South Louisiana's activity.

South Louisiana's long-standing reputation as an area of deep drilling is sustained in this month's survey of operations. Of the 182 wells completed during the month, 90, or nearly one-half, were drilled to depths below 10,000 ft. Nine of these had total depths below 15,000 ft., while 26 were in the 10,000-12,500-ft. depth range.

Average total depth of the 182 wells was 9,931.7 ft. Reflecting the trend toward deeper exploration, average depth of wildcat wells was much greater than that of field wells. Normally, as known field reservoirs at one depth are being developed, operators look to steadily deeper horizons for possible additional reserves. Thus it is natural that the average depth of wildcat wells of the month exceeded 11,600 ft., while that of fields was 9,490 ft., bringing the over-all average down. Offshore wildcats had a still higher average depth, nearly 12,300 ft.

South Louisiana's deep drilling also is reflected in the total footage of the 182 wells. This amounted to 1,807,573 ft., of which 1,366,640 ft. was in field wells to existing productive horizons, and 440,933 ft. in wildcat-classed wells. Offshore wells drilled 350,465 ft.

Viewing these figures, it is no mere

coincidence that the world's deepest hole, and deepest production are in South Louisiana. Currently, both records are held by the recently completed Richardson & Bass (and others) wildcat well 3 miles southeast of New Orleans in the Mississippi River Delta-marsh area of Plaquemines Parish. This well was drilled to 22,570 ft., and is oil productive at 21,419-65 ft. At Least a half dozen fields have production in sands below 15,000 ft.

South Louisiana's great thickness of sedimentary deposition offers almost unlimited opportunity for ultradeep exploration. Coastward, even the deepest tests have not gone through the Miocene section. Only the capacity of equipment and methods, and need for additional reserves now limit the depths to which drilling may be carried.

Average depth at which production of the 123 successful wells completed during the month was obtained was in the range of 8,900 to 9,000 ft.

Deep drilling, topography (much of it being swamp, marsh, or water beds, more or less controlled lease blocks), great drilling hazards, and other factors, have combined to make exploration and development costly and slow.

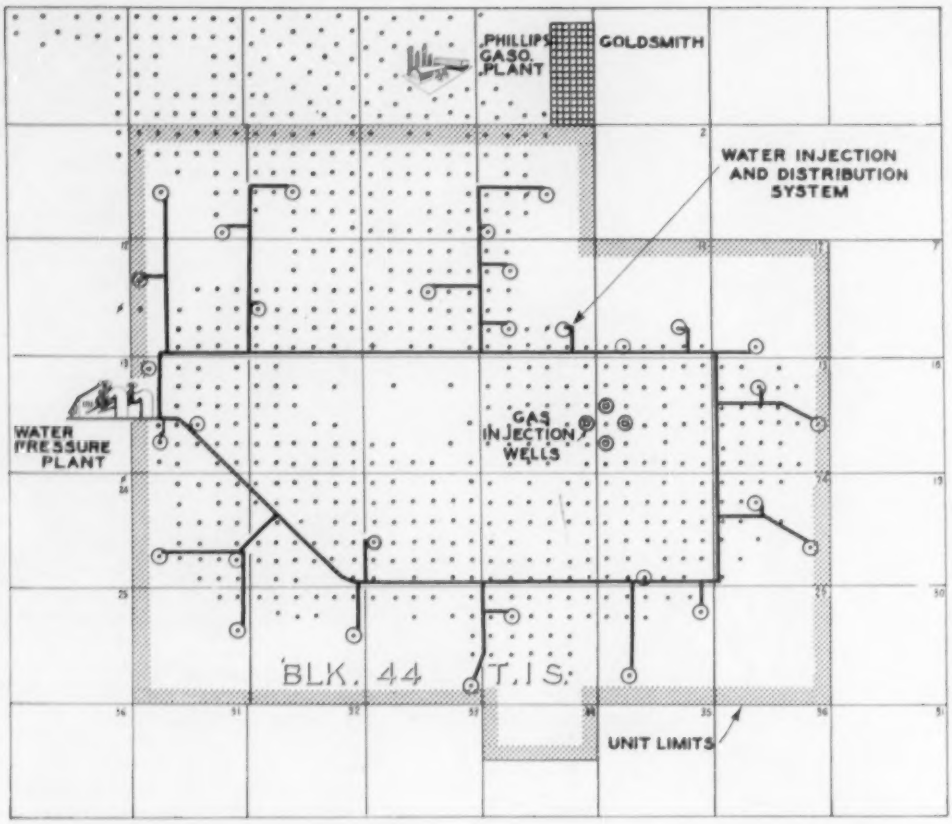
The punch-card survey of operations for the typical month bears out this situation. Five large companies, or groups of companies, drilled 70, or 38.5 per cent, of the 182 wells completed, and with this, 38.2 per cent of the total footage. The list (see accompanying tabulation) was headed by The Texas Co. with 21, or 11.5 per cent.

A recent report lists close to 325 active drilling operations in South Louisiana. Of these nearly 75 were in offshore areas (Gulf of Mexico, or off the East Coast in Breton Chandeleur Sounds). They included about 235 classed as field-development wells, and 90 as wildcats.

MONTHLY ANALYSIS OF LOUISIANA DRILLING

	Onshore wells— Field	Wildcat	Total	Offshore wells— Field	Wildcat	Total	Total wells— Field	Wildcat	Total
Oil	68	6	74	22	1	23	90	7	97
Condensate	7	4	11	1	1	2	8	5	13
Gas	10	2	12	0	1	1	10	3	13
Total successful	85	12	97	23	3	26	108	15	123
Dry	31	18	49	5	5	10	36	23	59
Total completions	116	30	146	28	8	36	144	38	182
Footage drilled	1,114,473	342,635	1,457,108	252,167	98,298	350,465	1,366,640	440,933	1,807,573
Average depth (ft.)	9,607.5	11,421.1	9,980.2	9,006.0	12,287.2	9,735.1	9,490.5	11,603.5	9,931.7
Total initial production (bbl.)	13,121	1,193	14,314	6,329	426	6,755	19,450	1,619	21,069
Average initial production (bbl.)	174.9	119.3	168.4	275.2	213.0	270.2	198.5	134.9	191.5
Success ratio (per cent)	73.3	40.0	66.5	82.1	37.5	72.2	75.0	39.5	67.6

IMMENSE PROJECT takes in almost a township. Water is flooding 14,100 productive acres from a peripheral pattern of injection wells.



The first in Texas—and one of first in U.S.

Goldsmith Pressure-Maintenance Project Is Living Up to Its Promise

by Robert J. Enright
Texas District Editor

ONE of the most closely watched pressure-maintenance projects in the country is the 14,100-productive-acre whopper conducted in the San Andres dolomite pay horizon of West Texas' Goldsmith field, Ector County, by the Goldsmith San Andres Unit.

The big program takes in Goldsmith's south dome—almost one-half of the huge 31,000-acre field. The unit was formed on October 1, 1952.

Water injection commenced on October 18, 1954, and is being injected into 275 ft. of the formation 25 ft. below the oil-water contact. Input is through 31 input wells located roughly in two concentric rings around the south dome. Over 31 million barrels of water have been injected to date. Gas is going into the dome's large gas cap through four wells on the crest of the structure (see map).

This project was the first such pressure maintenance operation in Texas, one of the first in the country, and the largest of its type in the world *(The Oil and Gas Journal, December 6, 1954, page 86)*, a type which, incidentally, was suggested several years ago as ideal by the Texas Railroad Commission.

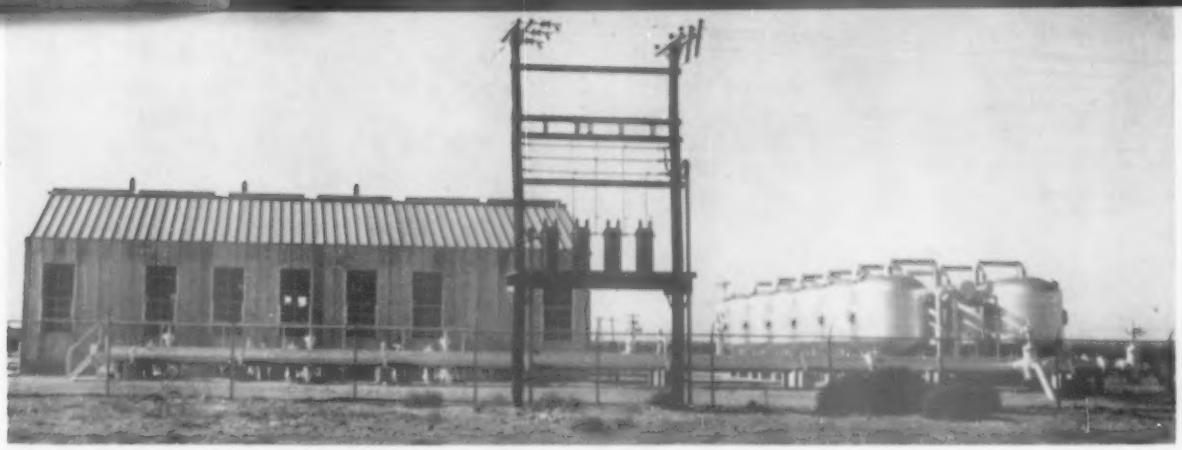
Gulf Oil Corp., operator of the big unit, terms the project successful so far and "living up to all expectations."

In the first 1½ years of water injection, reservoir pressure has not only been stabilized but is increasing at present oil-production rates.

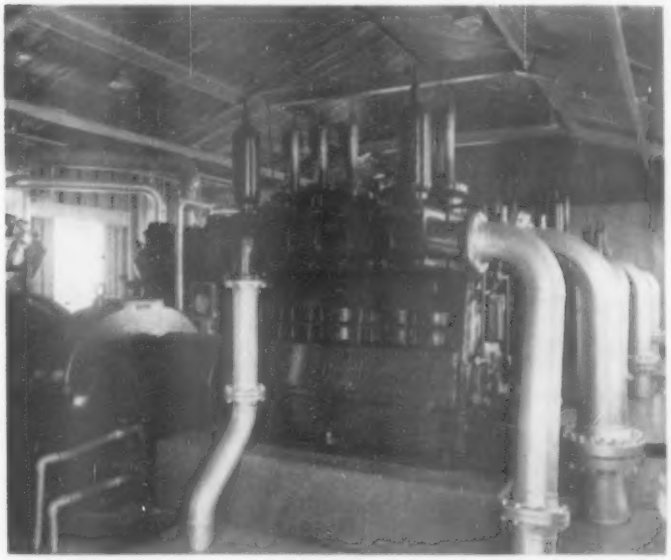
The unit, likewise, is now successfully producing its allowable below the 2,000:1 net gas-oil-ratio penalty limit, whereas it was not capable of this before the unit was formed.

Total cumulative production from the unitized portion of the field has reached 81,000,000 bbl. of oil. Even after more than 20 years of production, the unit area is still capable of making in excess of its allowable of some 17,000 bbl. per producing day and is considered far from depleted. Pressure maintenance

TEXAS-LOUISIANA
NEW ENGINEERING TECHNOLOGY



WATER-TREATMENT PLANT handles 60,000 bbl. of salt water a day. Besides corrosion inhibitor, filters at right provide the only treatment of the water. The water contains 400 p.p.m. of hydrogen sulfide so that inhibitor must be added at water wells.



QUINTUPLEX PUMPS driven by gas engines force water into the distribution system at about 650 psi. Each of the three pumps can deliver 26,280 bbl. daily at 1,000 psi. discharge pressure.

AUTOMATIC VALVE on water supply line is part of startup and shutdown operations. It holds pressure on line until supply pump starts up, then it opens simultaneously.

is expected to increase ultimate oil recovery by additional millions of barrels.

Unusual water setup . . . High-pressure dry gas for injection into the gas cap was available near at hand from Phillips Petroleum Co.'s natural-gasoline plant in the field. Gas is now going into the cap at a rate of about 10,000,000 cu. ft. a day.

An adequate supply of water for injection, however, was harder to come by.

The unit was forced to go approximately 31 miles to get enough. It gets about 60,000 bbl. of salt water a day from five supply wells completed in the Hendrick lime at about 3,550 ft. near Wink in Winkler County. The water is pumped through a 31-mile, 18-in. pipeline to the injection plant at Goldsmith. There it is filtered and moved through the distribution system and into the injection wells.

The entire water supply and injection system was designed so that capacity could be increased materially with a minimum of additional equipment.

The supply end . . . The water-supply wells are produced by electric-motor-driven vertical turbine-type pumps. All five have different capacities and rate from 30 to 100 hp.

Supply well No. 1 has a 50-hp., 5-stage unit rated at 1,750 r.p.m.; No. 2 has a 100-hp., 11-stage, 1,760-r.p.m. unit; No. 3 a 60-hp., 7-stage, 1,760-r.p.m.; No. 4 a 40-hp., 4-stage, 1,750-r.p.m.; and No. 5 a 30-hp., 3-stage, 1,750-r.p.m. unit.

The wells pump in various combinations into a 10,000-bbl. storage tank at the Hendrick pump station nearby.

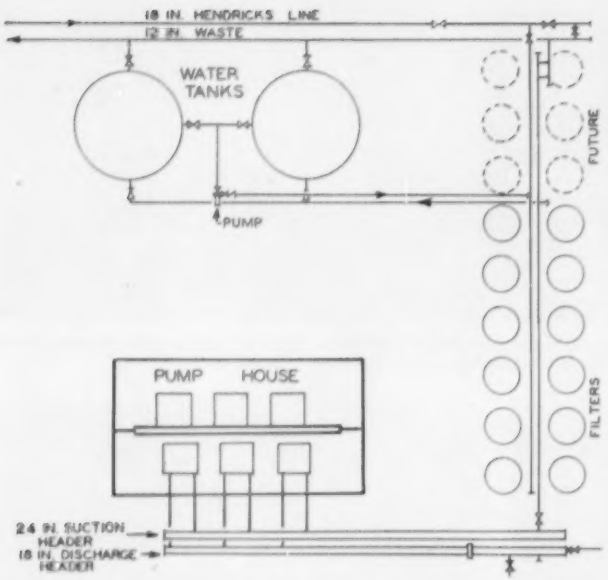
TEXAS-LOUISIANA
NEW ENGINEERING TECHNOLOGY

The water contains approxmately 6,000 p.p.m. total solids of which about 400 p.p.m. is hydrogen sulfide. Corrosion of equipment is mitigated by continuous addition of inhibitor.

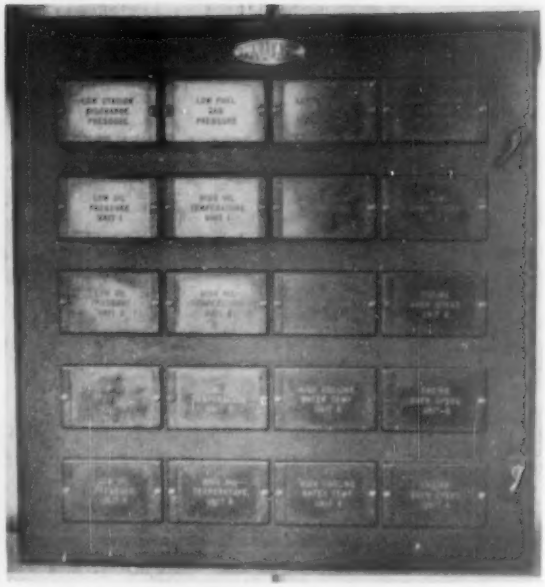
The inhibitor is injected continuously via electric-motor-driven, fractional-horsepower pumps at each well. Each pump is tied into a barrel of inhibitor and pumps the inhibitor into the tubing-casing annulus in concentrations which have varied from 9 to 26 p.p.m. Except for filtering, the water is not otherwise treated.

Hendrick pump station . . . The water is pumped through the 18-in. line to Goldsmith by two 200-hp. and one 75-hp. turbine-type centrifugal pumps at the Hendrick station.

The two 200-hp. units, each capable of delivering in excess of 30,000 bbl. of water daily with a differential head of 665 ft., are operated in parallel, while the 75-hp. unit (with a 60,000-bbl. capacity with a differential head of



LAYOUT OF PLANT includes 12 filters, 2 backwash tanks and 3 injection pumps. Elevation of supply line provides pressure to force water through filters.



ALARM PANEL flashes lights to indicate improper functioning of engines or pumps at Goldsmith station. In addition, a horn sounds to signal trouble.

130 ft.) is in series with the two large pumps.

The three operating simultaneously can deliver a maximum of 65,000 bbl. daily. At this rate discharge pressure is approximately 310 psi. The average injection rate is about 60,000 bbl. a day.

The pipeline operation is additionally unusual in that its route crosses the cap rock between the two terminals thus drastically varying in elevation. From Hendrick the line climbs 516 ft. to the top of the cap rock then drops 137 ft. on into Goldsmith.

The line thus has more drop than there is friction loss on the drop side.

The unit takes advantage of the roughly 60-psi. natural pressure on the pipeline (due to the elevation drop) at the Goldsmith station to push the water through filters. Otherwise it would have had to build draw-water storage and install pumps to do the job.

TEXAS-LOUISIANA
NEW ENGINEERING TECHNOLOGY

Goldsmith station . . . At Goldsmith, the water is passed through 12 pressure filters before entering pumps for distribution. The filters have an operating pressure of 125 psi. Anthrafilt is the filtering media. Each filter is backwashed every fourth day on the average.

There are two 3,000-bbl. tanks for storing backwash water. With one of the tanks filled with water, the backwash water is forced through the filters into the second tank, and, after settling, the procedure is reversed.

Water is moved into the distribution system by three gas-engine-driven vertical quintuplex pumps.

The pumps are rated at a maximum displacement of 26,280 bbl. daily each at 300 r.p.m. and 1,000 psi. discharge pressure. Each has a 6-in. stroke and a 5-in.-diameter plunger.

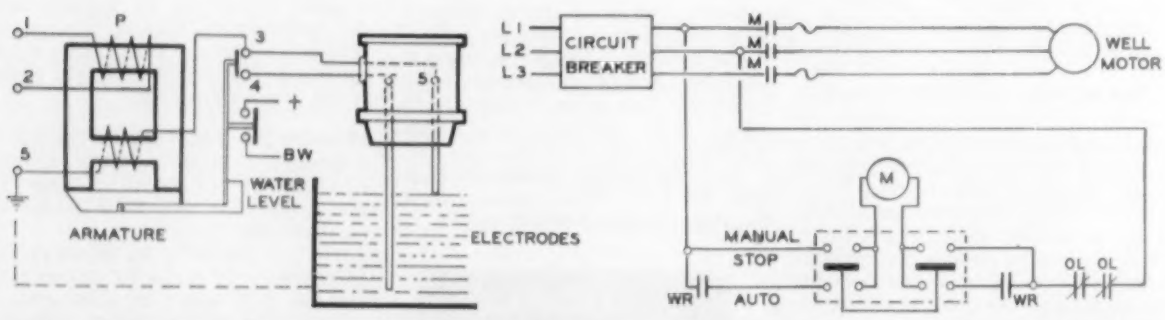
The gas engines, which are air-started, are rated at 544 b.hp. at sea level. They drive the pumps through gear reducers to give 300 r.p.m. on the pump at the rated r.p.m. of the engine.

Distribution and injection . . . Water volume is measured at the Goldsmith station as it enters the distribution system.

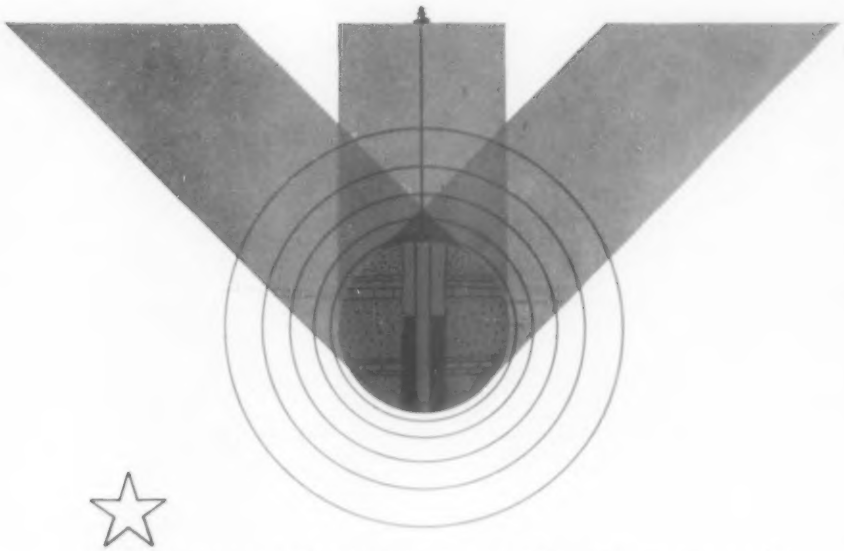
The latter is laid in a rough loop and includes 28 miles of pipe grading from 12-in. down to 3-in.

Two block valves in effect divide the system into three segments. This provides considerable flexibility in that any one of the segments can be closed off while continuing operation of the other two.

Operating pressure on the system is running about 650 psi. Valves are lo-



CONTINUOUS WATER SUPPLY is provided by these automatic controls. Figure at left shows the system that maintains the water level in the 10,000-bbl. storage tank at the Hendrick station. At the right is the control circuit for the water-supply wells. A sequencing relay rotates the starting order of the pumps to prevent overloading the power line.



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POZMIX 140

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★ "A worthwhile contribution to the oil industry . . ."

★ "Successfully cemented world's deepest well at 21,800 feet where temperature exceeded 340°F. . ."

★ *"Cement bill was 20% lower . . ."*

★ *"Productive sand was perforated, tested, fractured with no indication of channeling even though surface-recorded maximum treating pressure was 6,500 psi . . ."*

★ *"Have had repeated satisfactory performance . . ."*

These reports from well operators show the enthusiastic acceptance of Pozmix 140, Halliburton's new pozzolan-lime cementing material. Pozmix 140 has many important advantages that provide deephole protection never before possible for wells with temperatures greater than 140° F.

Let your Halliburton cementing operator tell you all about it. Phone the local or district office of the Halliburton Oil Well Cementing Company.

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HALLIBURTON CEMENTING SERVICES

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cated at each lateral-line connection with the main-distribution loop.

Input volumes are metered at each well. Water going into each input is controlled by an adjustable choke at the wellhead.

Automatic Controls

The Goldsmith pressure-maintenance project achieves a degree of automation via a system of flow and pressure controls at the Hendrick end of the pipeline.

Storage-tank level and water-well controls . . . Automatic operation of the water supply well is achieved by the use of water level probes in the 10,000-bbl. water storage tank. At preset water levels these probes energize relay circuits to the supply wells through messenger wires for starting and stopping the well pumps. Top and bottom water level controls are also provided. A sequencing service rotates the starting order of the wells.

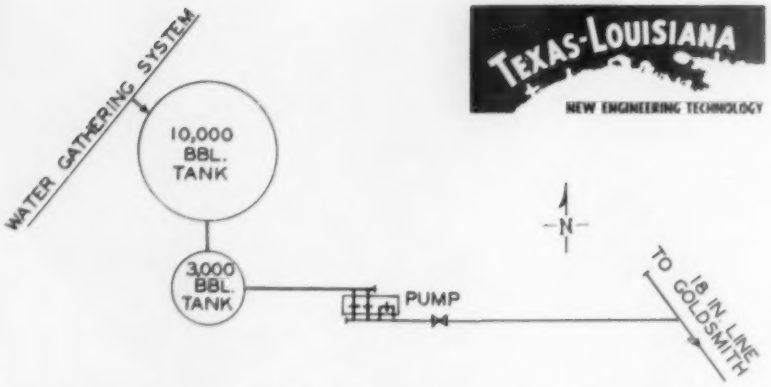
Main pump controls at Hendrick . . . Station controls are actuated by pressure and flow rate.

Under shutdown conditions, the pressure on the closed-in 18-in. water line is 10 to 15 psi. above the gravity head. This is accomplished by closing in the line while pump pressure is applied. When a unit is started at the Goldsmith station the locked-in pressure on the line is reduced to the gravity head. This loss of pressure at the Hendrick station closes a pressure switch and an interposing relay and starts the first 200-hp., 30,000-bbl. pump. An electrically operated valve opens simultaneously with the starting of the first pump. As the flow begins, the initiating circuit is opened by a flow-meter relay and the starter coil on the first pump is maintained in the closed position by a pressure switch which opens a little below the shutoff pressure of the pump.

In the case of only one pump operating, this one pump will shut down because of high discharge pressure when Goldsmith ceases to require water. However, throttled operation is permitted up to shutdown pressure.

If and when the Goldsmith station exceeds 30,000 bbl. per day the flow will slightly exceed 30,000 bbl. per day and the pressure at the Hendrick station will drop below normal. Through the operation of a pressure switch and a relay on the flow meter, the second 30,000-bbl. per day pump is started and also makes inoperative the pressure shutdown control on the first pump.

Immediately following this, an auxiliary contact of the second 200-hp. pump starter starts the 75-hp. pump through a time relay to prevent these two motors starting at once.



SUPPLY STATION gathers water from five wells into the storage tanks and pushes it 31 miles to Goldsmith with three centrifugal pumps. Pumps are controlled by flow meter so that only one will operate when water demand is low.

With all pumps running and flow increasing, a relay of the flow meter at 35,000-bbl. a day parallels a relay which the flow meter opens and locks out at 36,000 bbl. a day. This makes a required flow of 35,000 bbl. a day necessary to keep the second 200-hp. and the 75-hp. pump running. With this accomplished, output will be at capacity (or less as required by the injection plant).

A pressure switch set at just below station shutoff pressure shuts down all units due to pressure buildup when Goldsmith shuts down.

Should Goldsmith not shut down, but reduce requirements to less than 35,000-bbl. a day, then the second 200-hp. and the 75-hp. pumps are shut down due to the closing of the flow-meter relay at the 35,000-bbl. opening.

The first 200-hp. pump continues to run, delivering 30,000 bbl. to Goldsmith.

Alarm system . . . A low-level alarm and Hendrick station shutdown is provided by an electrode relay in the Hendrick storage tank. The alarm system includes both visual (trouble lights) and audio (horn) signals.

A pressure switch set below normal line pressure sets off the alarm whenever faulty operation or loss of system pressure occurs.

If the 75-hp. pump should fail to start, a pressure switch and an auxiliary contact on the motor starter gives the alarm.

A lockout relay cuts off the horn after a time when trouble arises but the indicating lights continue to burn until the trouble is corrected.

General . . . The initiating relays of the control system are all 48-volt d.c. type supplied from a 48-volt d.c. nickel-cadmium battery. The one exception is that the electrode relays of the tank-level control are supplied with 440-volt a.c. The contacts of the latter, however, are in a 48-volt d.c. remote well-control circuit.

All starter coils are 440-volt a.c., so chosen as to reduce the size of the battery required.

Rotary switches rotate the wells in sequence, shift the two 200-hp. pumps from No. 1 to No. 2 starting position, and provide transfer from manual to automatic operation.

BOOKS

OIL AND GAS LEASING ON INDIAN LANDS. By Alfred E. McLane. Published by F. H. Gower, 2240 Mile High Center, Denver 2, and Matthew T. Bender Co., Albany 1, N. Y. 407 pp.

This book's purpose is to discuss such general questions as: Who are Indians? Where are their lands? How and upon what terms and conditions may their lands be leased for oil and gas? It emphasizes some of the fundamental differences between Indian lands and federal public domain. This book touches generally upon the many minor differences in laws in procedure pertaining to oil and gas leases on the two types of land ownership.

Only a very few volumes have been published on oil and gas leasing of Indian lands. Here, the author has grouped specific material on Indian lands which should be beneficial since the body of Indian law rests upon more than 4,000 treaties and statutes, plus thousands of administrative rulings.

FUEL INJECTION SYSTEMS. Third edition. By Brian P. Emerson, editor of Diesel Power. Published by Diesel Publications, Inc., 80 Lincoln Avenue, Stamford, Conn. 220 pp., $2.

This is a revised edition containing both addition of systems, introduced since the last publication in 1950, and expanded coverage of other systems.

Fuel-injection equipment, heart of the diesel engine, has undergone extensive changes in the past 6 years. New developments are included and the book is written to give the beginner a clear understanding. Specific service data for men in injection repair shops are included.

Eleven injection systems in common usage are described as well as illustrated; their operation is detailed; and servicing data are given.

An extensive chapter is devoted to modern servicing techniques and the tooling used.

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T.P.R.C. REPORT:

Estimated Recoverable Gas Reserves by Geological Formations . . . (Texas)

by Charles A. Breitung

DIST 1: SOUTHWEST AND SOUTH CENTRAL TEXAS

(Billions of cubic feet—14.65 psia. at 60° F.)

District, geologic age, and group or formation—	Gas reserves, Jan. 1, 1956— Dissolved and associated	Non-associated	Total
Eocene:			
Jackson	2.1		2.1
Yegua	4.6		4.6
Queen City	0.3	2.5	2.8
Carrizo		(*)	
Wilcox	29.3	45.1	74.4
Total Eocene	36.3	47.6	83.9
Cretaceous:			
Navarro	25.9	75.5	101.4
Taylor	0.3		0.3
Austin	3.4	7.0	10.4
Serpentine	2.7	0.6	3.3
Buda	(*)		
Edwards	51.4	14.4	65.8
Total Cretaceous	83.7	97.5	181.2
Pennsylvanian:			
Strawn		144.8	144.8
Total Pennsylvanian		144.8	144.8
Ordovician:			
Ellenburger	(*)		
District total	120.0	289.9	409.9

DIST. 2: LOWER GULF COAST

Miocene	4.4	393.0	397.4
Oligocene:			
Catahoula	36.3	152.0	188.3
Anahuac	395.4	180.4	575.8
Frio	1,145.3	1,443.5	2,588.8
Vicksburg	17.7	360.0	377.7
Total Oligocene	1,594.7	2,135.9	3,730.6
Eocene:			
Jackson	3.2	25.0	28.2
Yegua	20.8	345.0	365.8
Cook Mountain	0.3	2.0	2.3
Recklaw	3.3	185.0	188.3
Wilcox	91.0	2,320.0	2,411.0
Total Eocene	118.6	2,877.0	2,995.6
District total	1,717.7	5,405.9	7,123.6

DIST. 3: UPPER GULF COAST

Pleistocene:			
Lissie	0.4		0.4
Pleistocene-Pliocene	4.7		4.7
Pliocene	25.1		25.1
Pliocene-Miocene:			
Largarto	1.5		1.5
Pliocene-Miocene (misc.)	26.7		26.7
Oakville	2.6	6.5	9.1
Total Pliocene-Miocene	30.8	6.5	37.3
Miocene:			
Cap Rock	40.2		40.2
Other Miocene	306.2	1,063.0	1,369.2
Total Miocene	346.4	1,063.0	1,409.4

Author is oil and gas consultant, Austin, Tex.

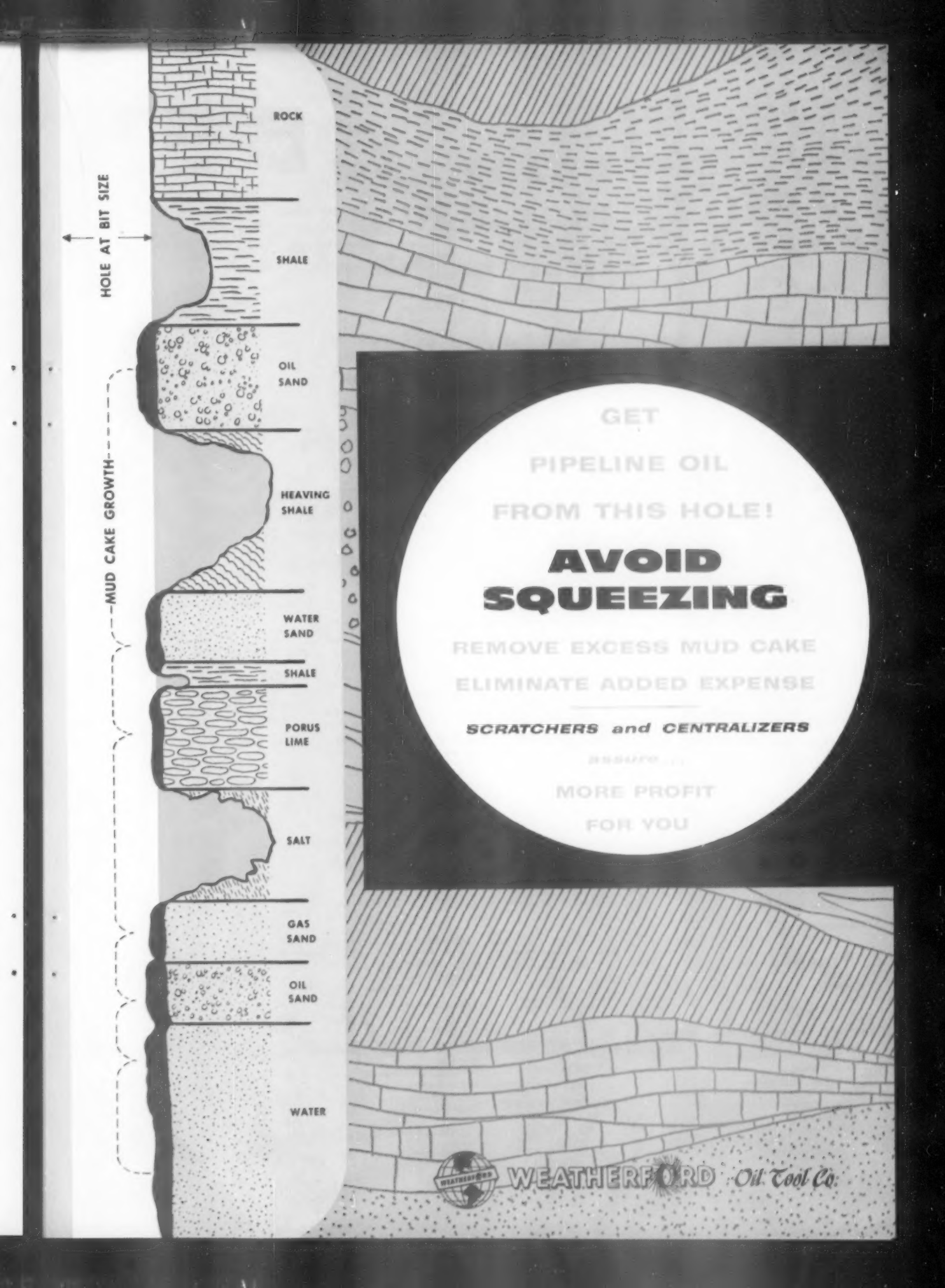
District, geologic age, and group or formation—	Gas reserves, Jan. 1, 1956— Dissolved and associated	Non-associated	Total
Oligocene:			
Catahoula	1.1	466.0	467.1
Discorbis	1.7	44.0	45.7
Heterostegina	18.7	23.0	41.7
Marginulina	752.1	494.0	1,246.1
Marg.-Frio	15.2	137.0	152.2
Anahuac	15.6		15.6
Frio	3,362.8	9,890.0	13,252.8
Vicksburg	82.8	68.0	150.8
Other Oligocene	64.8	91.0	155.8
Total Oligocene	4,314.8	11,213.0	15,527.8
Eocene:			
Cockfield	733.6	312.0	1,045.6
Jackson	63.1		63.1
Yegua	314.4	6,497.0	6,811.4
Cook Mountain	39.7	44.0	83.7
Sparta	3.2	0.3	3.5
Mount Selman	0.5		0.5
Recklaw	(*)		
Wilcox	68.0	2,103.0	2,171.0
Other Eocene	0.1	0.5	0.6
Total Eocene	1,222.6	8,956.8	10,179.4
Cretaceous:			
Edwards	0.1	0.2	0.3
Woodbine		29.0	29.0
Total Cretaceous	0.1	29.2	29.3
Miscellaneous	2.2	123.7	125.9
District total	5,947.1	21,392.2	27,339.3

DIST. 4: SOUTH TEXAS

Miocene:			
Oakville	4.2	232.0	236.2
Oligocene:			
Catahoula	35.7	331.0	366.7
Heterostegina	4.3	76.0	80.3
Marginulina	18.2	137.0	155.2
Frio	823.5	14,168.7	14,992.2
Vicksburg	82.3	3,590.0	3,672.3
Total Oligocene	964.0	18,302.7	19,266.7
Eocene:			
Jackson		602.0	602.0
Whitsett	123.2		123.2
McElroy	255.1		255.1
Caddell	64.4		64.4
Total Jackson	442.7	602.0	1,044.7
Yegua	58.6	129.0	187.6
Cook Mountain	(*)		
Queen City		74.0	74.0
Wilcox	(*)	582.0	582.0
Total Eocene	501.3	1,387.0	1,888.3
Miscellaneous	14.6		14.6
District total	1,484.1	19,921.7	21,405.8

DIST. 5: EAST CENTRAL TEXAS

Cretaceous:			
Navarro:			
Nacatoch	1.4	5.0	6.4
Gibson	2.1		2.1
Total Navarro	3.5	5.0	8.5
Taylor	0.3	1.0	1.3
Eagle Ford	1.1		1.1
Woodbine	203.3	288.7	492.0
Washita:			
Buda	(*)		
Georgetown	(*)		
Total Washita	(*)		


ROCK
HOLE AT BIT SIZE
SHALE
OIL SAND
MUD CAKE GROWTH
HEAVING SHALE
WATER SAND
SHALE
POROUS LIME
SALT
GAS SAND
OIL SAND
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REMOVE EXCESS MUD CAKE
ELIMINATE ADDED EXPENSE
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District, geologic age, and group or formation—	Gas reserves, Jan. 1, 1956— Dissolved and associated	Non-associated	Total
Walnut	0.1		0.1
Paluxy	8.4		8.4
Glen Rose:			
Upper Glen Rose	(*)	7.0	7.0
Bacon limestone	21.2	12.0	33.2
Lower Glen Rose:			
Hill, Gloyd, Young, Rodessa, etc.	4.1	287.0	291.1
Pettet	0.2	238.0	238.2
Total Glen Rose	25.5	544.0	569.5
Travis Peak	(*)	202.0	202.0
Total Cretaceous	242.2	1,040.7	1,282.9
Jurassic:			
Buckner limestone		18.6	18.6
Total Jurassic		18.6	18.6
District total	242.2	1,059.3	1,301.5
DIST. 6: EAST TEXAS			
Eocene:			
Queen City	(*)		
Recklaw	(*)		
Carrizo	0.4		0.4
Total Eocene	0.4		0.4
Cretaceous:			
Navarro	1.9	21.0	22.9
Austin	0.4		0.4
Eagle Ford	64.1	14.0	78.1
Woodbine	1,377.3	1,036.0	2,413.3
Fredricksburg (Goodland)	(*)		
Paluxy	204.8	251.0	455.8
Glen Rose (Upper)	8.6	92.0	100.6
Glen Rosé (Lower Rodessa)	188.2	1,497.0	1,685.2
Glen Rose (Lower Pettet)	153.4	6,963.6	7,117.0
Travis Peak	137.5	865.0	1,002.5
Total Cretaceous	2,136.2	10,739.6	12,875.8
Jurassic:			
Cotton Valley		18.0	18.0
Smackover limestone	0.8	6.0	6.8
Total Jurassic	0.8	24.0	24.8
District total	2,137.4	10,763.6	12,901.0
DIST. 7-B: NORTH CENTRAL TEXAS			
Permian:			
Wolfcamp	116.9	1.0	117.9
Total Permian	116.9	1.0	117.9
Pennsylvanian:			
Cisco	53.0	1.0	54.0
Canyon	45.0	7.0	52.0
Strawn	161.0	133.0	294.0
Bend	61.0	139.3	200.3
Total Pennsylvanian	320.0	280.3	600.3
Ordovician:			
Ellenburger	23.0	1.0	24.0
Total Ordovician	23.0	1.0	24.0
Cambrian	(*)		
District total	470.9	290.3	761.2
DIST. 7-C: WEST CENTRAL TEXAS			
Permian:			
Guadalupe (Grayburg)	245.4	47.8	293.2
San Andres	14.1	38.0	52.1
Glorieta	(*)		
Clearfolk	3.5		3.5
Clear Ford-Wichita (Spraberry)	702.6	53.5	756.1
Wolfcamp	30.8	28.2	59.0
Miscellaneous Permian	2.1	0.2	2.3
Total Permian	998.5	167.7	1,166.2

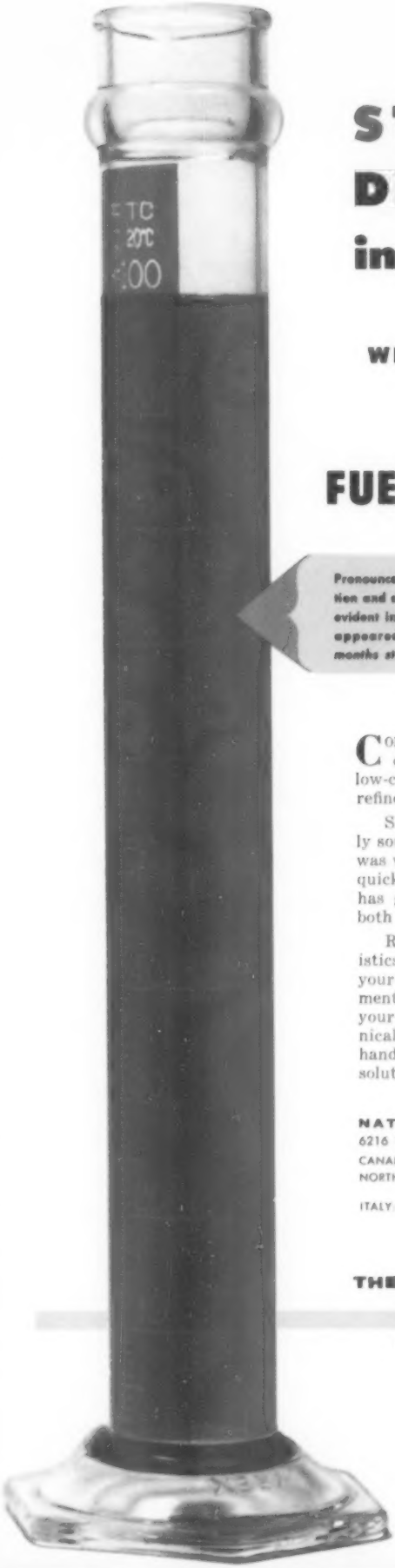
Pennsylvanian:			
Cisco	8.3	71.0	78.3
Canyon	15.5	153.7	169.2
Strawn	495.3	81.4	576.7
Bend	2.5	2.5	5.0
Miscellaneous Pennsylvanian	3.4		3.4
Total Pennsylvanian	525.0	308.6	833.6
Devonian	2.0		2.0
Silurian (Middle):			
Fusselman	10.0	30.0	40.0
Ordovician (Lower):			
Ellenburger	194.3	139.3	333.6
District total	1,729.8	645.6	2,375.4
DIST. 8: WEST TEXAS			
Permian:			
Ochoa	0.2		0.2
Whitehorse	1,910.8	252.6	2,163.4
San Andres	3,982.4	66.2	4,048.6
Clearfork	954.6	46.5	1,001.1
Wichita	14.1		14.1
Wichita-Clearfork (Spraberry)	708.8		708.8
Wolfcamp	15.2		15.2
Total Permian	7,586.1	365.3	7,951.4
Pennsylvanian:			
Cisco	74.7		74.7
Canyon	2,182.7	3.5	2,186.2
Strawn	169.0		169.0
Bend	5.6		5.6
Total Pennsylvanian	2,432.0	3.5	2,435.5
Mississippian	0.8		0.8
Devonian	402.9	56.4	459.3
Silurian	70.6	3.2	73.8
Ordovician:			
Miscellaneous	33.4	160.0	193.4
Ellenburger	1,064.2	210.3	1,274.5
Total Ordovician	1,097.6	370.3	1,467.9
Miscellaneous	22.8	3.0	25.8
District total	11,612.8	801.7	12,414.5
DIST. 9: NORTH TEXAS			
Permian:			
Wichita Albany	(*)		
Pennsylvanian:			
Cisco	54.1	3.0	57.1
Canyon	37.0		37.0
Strawn	642.8	3.6	646.4
Bend	221.8	902.4	1,124.2
Total Pennsylvanian	955.7	909.0	1,864.7
Mississippian:			
Chester	1.7		1.7
Osage	14.5	0.4	14.9
Total Mississippian	16.2	0.4	16.6
Ordovician:			
Simpson	15.2	16.5	31.7
Ellenburger	75.8	6.4	82.2
Total Ordovician	91.0	22.9	113.9
Miscellaneous	9.2		9.2
District total	1,072.1	932.3	2,004.4
DIST. 10. TEXAS PANHANDLE			
Permian	56.6	120.0	176.6
Permian-Pennsylvanian	803.1	12,542.9	13,346.0
Pennsylvanian	46.5	6,572.2	6,618.7
Mississippian	(*)		
Ordovician	12.0		12.0
District total	918.2	19,235.1	20,153.3

*Negligible.

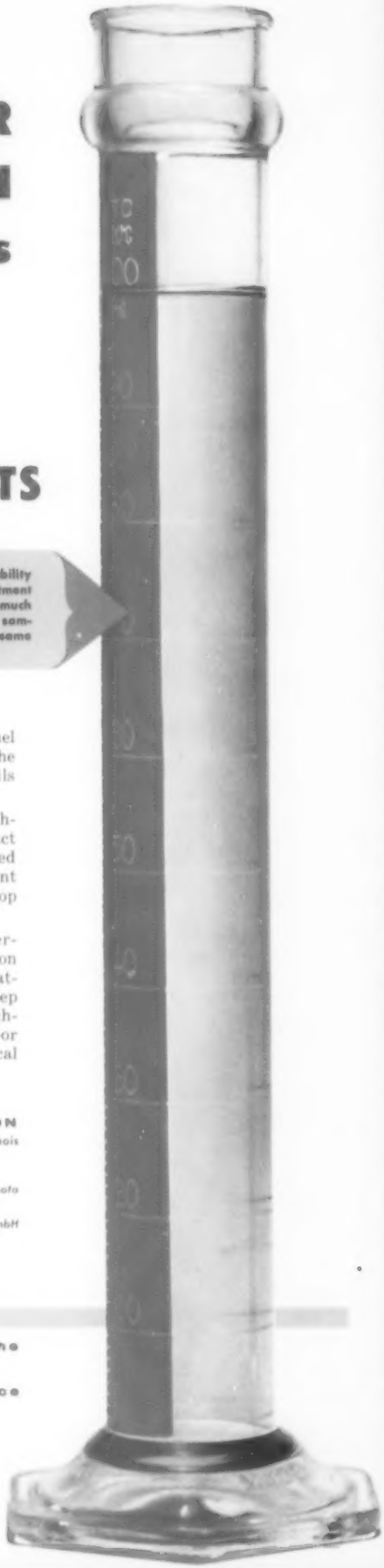
STOP COLOR DEGRADATION in distillate fuels

WITH *Nalco*

FUEL OIL TREATMENTS



Pronounced color degradation and sludging tendencies evident in this distillate fuel appeared *after* only 2½ months storage.



Despite extreme instability of the oil, Nalco treatment was effective. Note much lighter color of treated sample . . . same oil, same storage period.

COLOR degradation is a sure profit-cutter in fuel oils . . . but Nalco stabilizing treatment is the low-cost way to *stop* color degradation, keep oils refinery-fresh looking and acting.

Samples illustrated were refined from a highly sour crude; T.C.C. processed. Finished product was very unstable and color degradation occurred quickly in storage. Addition of Nalco treatment has greatly increased stability . . . helped stop both color degradation and sludge formation.

Regardless of your crude charge characteristics or processing methods, you can depend on your Nalco Representative to recommend treatment that will inhibit color degradation and keep your fuel oils at top salability. Write for Technical Data on Nalco Fuel Oil Treatments—or hand us your problem for a prompt, practical solution.

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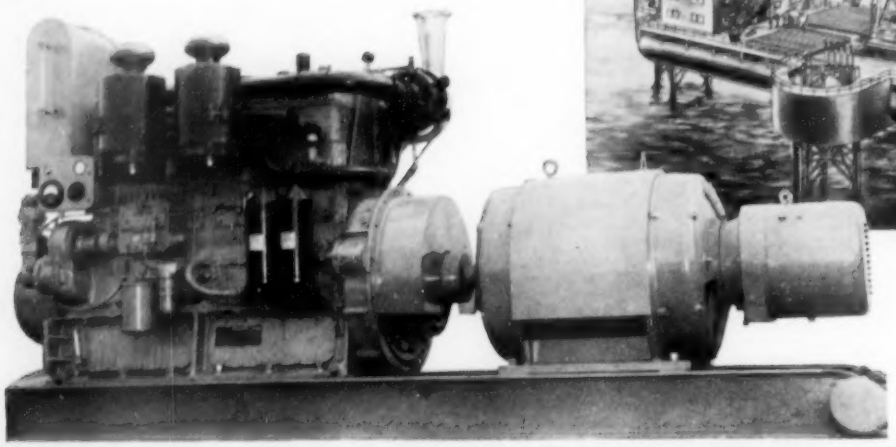
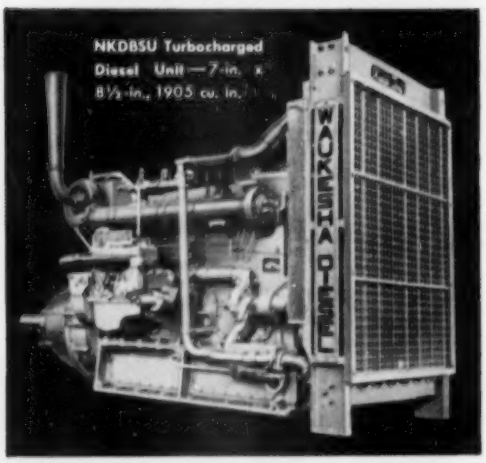
THE *Nalco*® **SYSTEM . . . Serving the Petroleum Industry through Practical Applied Science**

on the ZAPATA off-shore platform



WAUKESHA *Turbodiesels* supply reliable generator power



This mobile off-shore platform of the Zapata Off-Shore Company of Houston, Texas, has two engine generator sets to supply auxiliary power. A 1200 rpm Model NKDBS Waukesha Turbodiesel powers each of these 200 KW, 3-phase, 120/208 volt generator sets which are built by the Reagan Equipment Co. of New Orleans, La.

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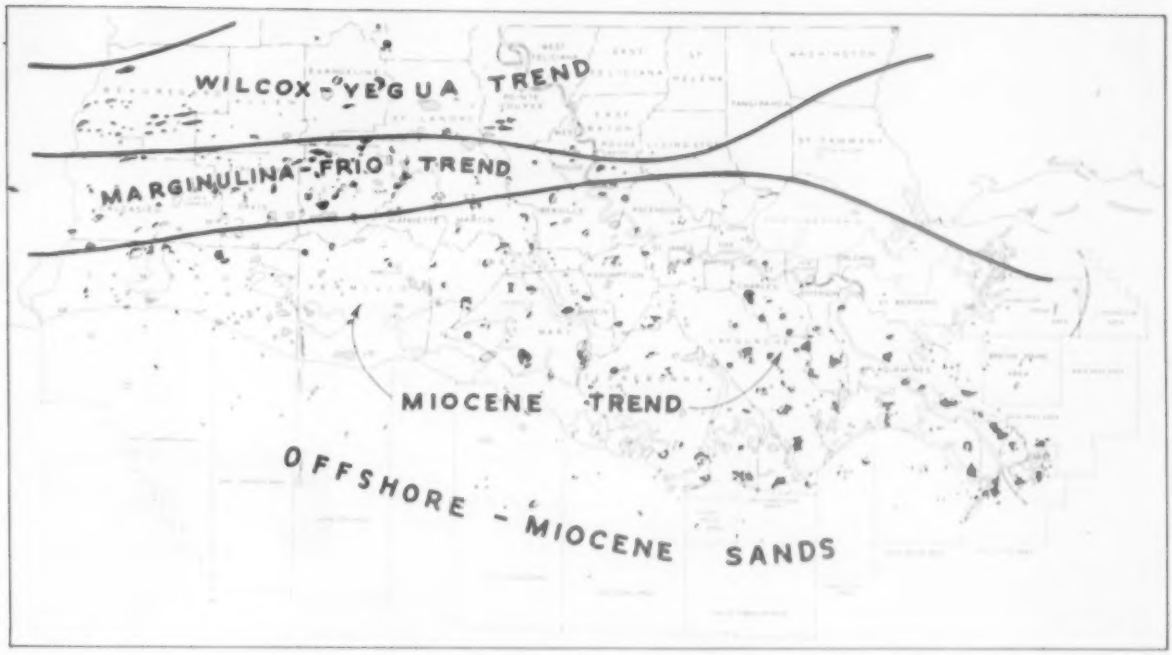


PRODUCTION in South Louisiana is confined to known Tertiary sand trends. Fig. 1.

In South Louisiana Old Fields Never Die

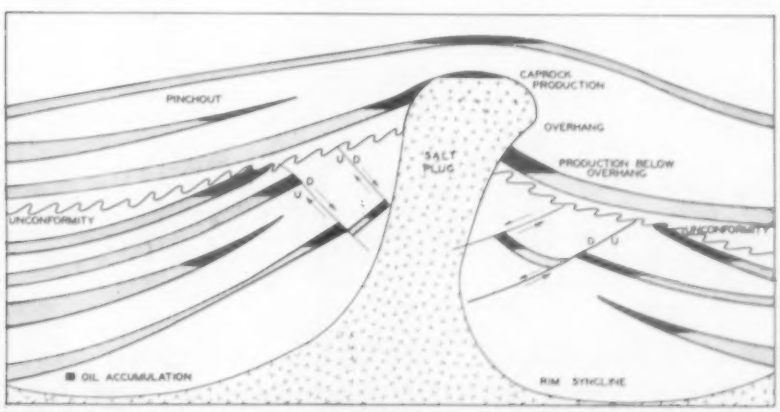
Nearly three-quarters of drilling activity is currently in these oldsters

by Norman S. Morrisey
Drilling Development Editor

TODAY in South Louisiana, old fields account for 72 per cent of the current drilling activity. Fields that are over 10 years old are still the main source of new oil for South Louisiana.

The possibilities of these large and prolific structures are virtually unlimited. The only limiting factor to deep production on the flanks of many of these old fields is the rig capacity and the safety factors of the equipment involved. Successful completion of the Richardson & Bass 1 L.L.&E. and Humble "L," world's deepest producer, has had a profound impact on geological thinking and opened many flank areas for intensive deep wildcatting.

South Louisiana's swamps and bayous are teeming with activity as "doodlebuggers" reshoot areas that have previously been condemned by dry holes or earlier inadequate seismic work. In the light of deeper drilling and better seismic field techniques, the oil possibilities of many of the subsurface and gravity leads have brightened considerably.



SCHEMATIC DIAGRAM showing some of the many possible traps around salt domes. Fig. 2.

Miocene trend . . . The biggest incentive for renewed interest in South Louisiana are the reserves in the Miocene sands. These sands occur in a fairly narrow strip along the southern margin of the state and continue to thicken seaward. A rare combination of sedimentation, salt movement, and oil accumulation has combined to make South Louisiana the envy of every oil-producing state in the nation.

The reserves of these sands put the Miocene trend in a class by itself as an

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NEW ENGINEERING TECHNOLOGY

attractive venture. Engineers speak in terms of 800 bbl. of oil per acre-foot of pay sand, but values as high as 1,400 bbl. per acre-foot have been recorded. On top of that, the Miocene trend is not a "one-shot" proposition. Under favorable conditions, there are innumerable sands present; any one, or possibly several, will produce. Typically, the fields have active water drives, so that the lifting costs are relatively low and the fields are noted for their longevity.

Flank production . . . But why all the interest in the old established fields? The answer is new geological thinking. Actually, the concepts have been developed over a period of years and today we are seeing the results in terms of flank production on even the oldest known salt domes. Today it is a well recognized fact that the salt dome affects a large area surrounding the salt mass itself. On the flanks of the domes are innumerable oil traps: concealed faults, sand pinchouts, and unconformities. And the beauty of it is that not one pay sand is present, but several. Fig. 2 is a schematic diagram showing some of the many oil traps that are present or that can exist on and near the salt mass.

Lake Washington, located 40 miles southeast of New Orleans, is the busiest oil field in the Miocene trend with 11 rigs active. Yet it was originally discovered in 1931, and still has reserves that approach the 100-million-barrel mark.

Deep pay zones . . . Deep drilling has done much to keep South Louisiana in the exploration spotlight. The Amelia-East Lake Palourde area is typical of so many condemned prospects in South Louisiana. Original dry holes, drilled to 12,000 ft., confirmed the seismic structure, but simply were not drilled deep enough to tap the sands that now produce. On the north flank of Weeks Island, an old salt dome that was mapped prior to the turn of the century, production was found in 1953 at depths of 16,000 to 17,500 ft. During 1955, South Louisiana had 1,025 wells that were drilled below 10,000 ft.; this represents 56 per cent of the total deep drilling in the United States.

Offshore . . . With 60 rigs running offshore, the tidelands is the scene of an intense drilling campaign. The results in 1956 have been highly encouraging and tend to confirm the optimistic hopes of the companies that have gambled so heavily on offshore prospects. During the first 4 months of 1956, there were 10 successful wildcats and only 12 dry holes for a success ratio of 45 per cent. This is even better than the excellent success record onshore of 36 per cent for exploratory drilling.

TABLE 1—1956 EXPLORATORY SUCCESS RECORD FOR SOUTH LOUISIANA

	Oil	Gas	Dry	Total	Per cent successful
Onshore:					
January	13	1	31	45	31
February	12	2	22	36	39
March	10	2	18	30	40
April	12	0	20	32	38
Total	47	5	93	143	36
Offshore:					
January	1	1	4	6	33
February	1	1	2	4	50
March	2	1	5	8	38
April	2	1	1	4	75
Total	6	4	12	22	46

From a geologist's viewpoint, the offshore is very similar to the onshore. The same type structures produce and the Tertiary sands are the main reservoirs. The Miocene section increases in thickness seaward and younger sands are present offshore that are missing inland. Much of the present drilling activity is concentrated around the Mississippi Delta where the Miocene section is relatively thick and where the pay sands are exceptionally well developed.

In spite of the newer designs in drilling equipment, it will take many years to adequately explore and develop the offshore reserves. At first the operators will drill the first-class prospects, and then they will begin to exploit the smaller anomalies. Finally they will reach the stage where the emphasis will be on flank production. After 50 years, exploration on land is still in this phase in South Louisiana. A similar cycle should be repeated offshore, promising a good future for both the offshore operators, drilling contractors, and service companies.

Oligocene trend . . . North of the Miocene trend lies the Frio-Marginulina trend. Along this trend there are many rich oil fields. Since the drilling is not so hazardous as in the Miocene as a general rule, the Oligocene trend is more attractive to the independents. Here again, many of the fields have active water drives and the reserves are high, although usually not on a par with the Miocene sands. Typical Frio oil sands have reserves on the order of 500 bbl. per acre-foot of pay. Today the trend even on this trend is toward deeper production.

Faulting plays an important role in controlling production. Both shallow and deep-seated salt domes produce on the Oligocene trend.

Outlook . . . Without question, South Louisiana will remain at or near the top of the nation's exploration "hot spots" for the next several years. Results of wildcat exploration for 1956 have been highly encouraging: 52 successes out of 143 wildcats. The only spot in the nation that overshadows South Louisiana is the offshore area, but the two are so intimately related that they are often referred to in the same breath. Both the land and offshore production are in the same geologic province. Production in both areas is related to salt movement. The main producing reservoirs are sands in the Tertiary, usually Miocene sands, although younger sands, possibly Pleistocene, are believed oil bearing in offshore waters.

But one of the best barometers for future activity is the seismic activity. Usually an intensive seismic campaign precedes an active wildcat program. Today, 101 seismic crews are blasting away in South Louisiana's swamps and bayous. And this represents 19 per cent of the total seismic activity in the United States. It will take the oil companies several years to cash in on the results of this shooting, insuring South Louisiana of an active drilling campaign for several years to come.

"Without question, South Louisiana will remain at or near the top of the nation's exploration 'hot spots' for the next several years."

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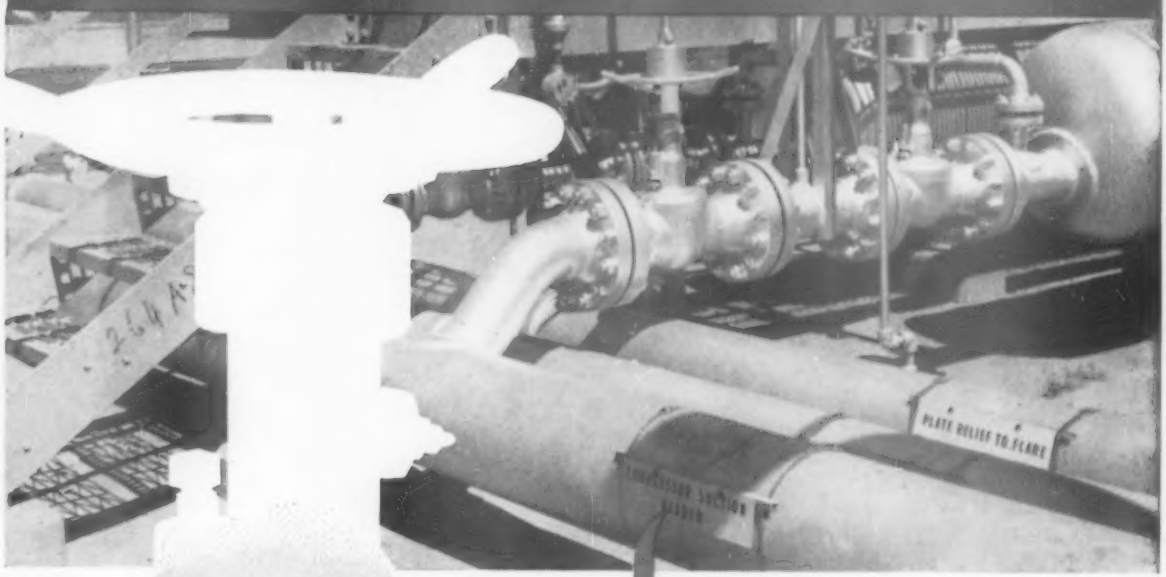

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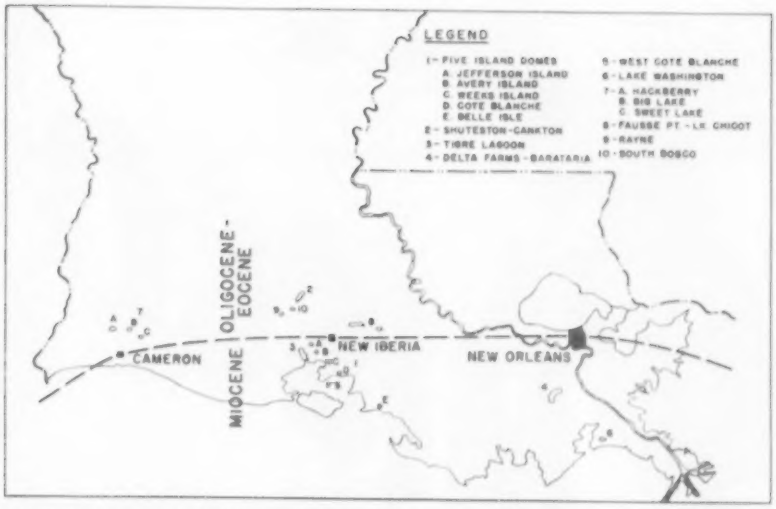

THE TWO MAIN PRODUCING TRENDS in South Louisiana are the Miocene and the Oligocene-Eocene. The high reserves and the numerous pay zones have lured many new operators into this rich oil province. Fig. 1.

Geologically Speaking . . .

Here's the picture in South Louisiana

by James A. Seglund

SO many operators have moved into South Louisiana, or are now concentrating their activities there, that open acreage is as difficult to come by as office space is to find in the cities of New Orleans or Lafayette.

This resurgence of activity is attributed to the high ratio of success in wildcatting, the multiple pays found in most fields, and the high recovery factor which can be applied to the very permeable and porous sands of the South Louisiana Gulf Coast. Of course, the promise of huge oil and gas reserves off the coast of Louisiana is attracting the major companies and larger independents. All in all, it appears as though activity will continue to increase along the promising Gulf Coast.

Perhaps now is the time to set forth certain basic geological concepts of the Gulf Coast so it will be better known just what we are dealing with in South Louisiana. Most of the Gulf Coast geology is gathered on a fragmentary basis; a piece from a technical article, papers at a convention, and conversations among geologists. Some geological concepts are rejected; others are enlarged upon.

Most of the geological ideas should be gathered from men who have worked in the Gulf Coast for many years but unfortunately, in a sense, most of these men are put into executive capacity where their stimulating geological thought is buried under a mountain of management and personnel problems.

The author is a consultant, New Orleans.

Regional Geology

Geologically, the Louisiana Gulf Coast is a portion of a long east-west-trending trough extending westward into South Texas and southeastward off the coast of Mississippi. This trough is most often referred to as the Gulf Coast geosyncline. During the time of the Tertiary period (in which we are interested) the geosyncline received a continual deposition of sediments from rivers flowing southward. The rivers shifted their axes east and west many times due to slight land tiltings and naturally formed depositional barriers.

Some of the sediments as they emerged from the river mouths, were carried up and down the ancient shore lines by ocean currents and deposited. The axis of the geosyncline was further to the north during the early stages of the Tertiary and gradually shifted southward with time. The ancient shore lines with river mouths were also farther north than at present. However, these shore lines fluctuated north and south great distances many times during the general southward movement of the axis of the geosyncline. The sea fluctuations are primarily attributed to effects of glacial periods and mountain-building activities in the surrounding country. As with most things in nature, there is a rhythmic cycle within a larger rhythmic cycle within a larger rhythmic cycle within a larger rhythmic cycle and ad infinitum. It is much like numerous sine curves imposed one upon the other.

With the gradual southward movement of the axis of the geosyncline, there was an accompanying southward movement of what is called the hinge line. A hinge line for the Gulf Coast formation is defined as a line south of which there is abnormal thickening of the formation and a sharp increase in the rate of southward dip. It represents the point of inflection along the curve of the north limb of a geosyncline beyond which most of the downwarping of the geosyncline took place.

The location of the hinge line was also controlled by proximity to the more stable northward land mass. That is, more stable conditions on the north extended influence into the north side of the geosyncline tending to make this portion of the geosyncline more stable. However, southward from the old land area a point exists where the land influence can no longer control the weight of sediments being dumped in the gulf. At this point, the geosyncline takes over complete control of the regional structure. Of course, these sharp changes in dips at the hinge line created many fractures along the hinge line, and they are believed to have initiated many of the regional fault trends known through the Gulf Coast area (Fig. 2).

The particular hinge line which initiated a particular fault trend is believed to lie deeper than is usually explored by the drill in the fault zone. It is even possible that deep drilling south of these down-to-the-south normal faults will reveal buried complementary-type normal faults down-to-the-north. That is, regional fault trends are associated with deep-seated graben fault trends similar to those found in Texas, South Arkansas, and North Louisiana.

The sediments of interest along the Louisiana Gulf Coast are principally Tertiary in age. They can be listed from youngest to oldest as follows:

Pliocene.

Miocene.

Oligocene: Anahuac formation, Frio formation, Vicksburg formation.

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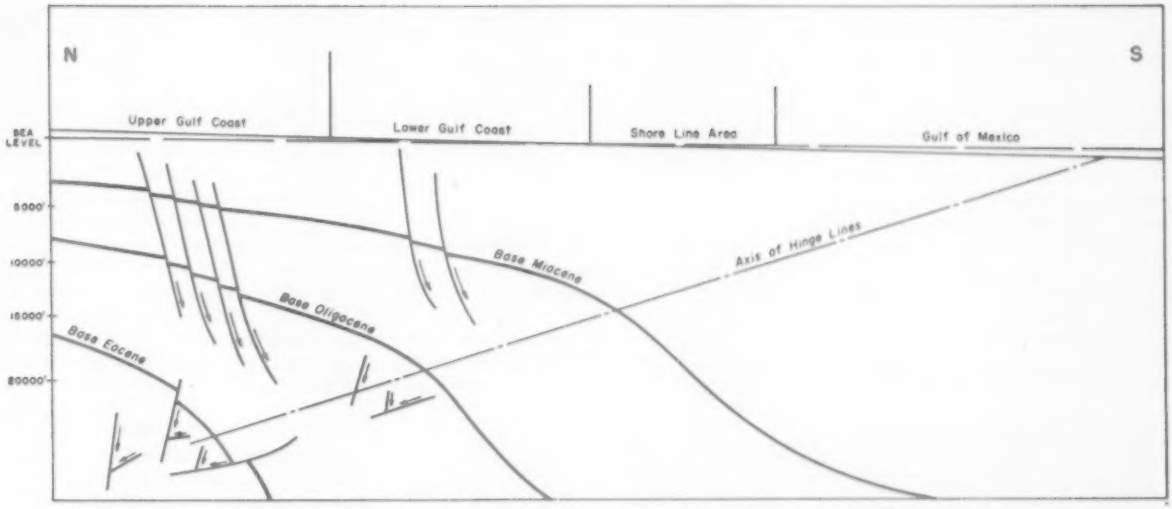

AXIS OF THE HINGE LINES shifts from north to south. In this generalized cross-section, the salt domes are omitted. Fig. 2.

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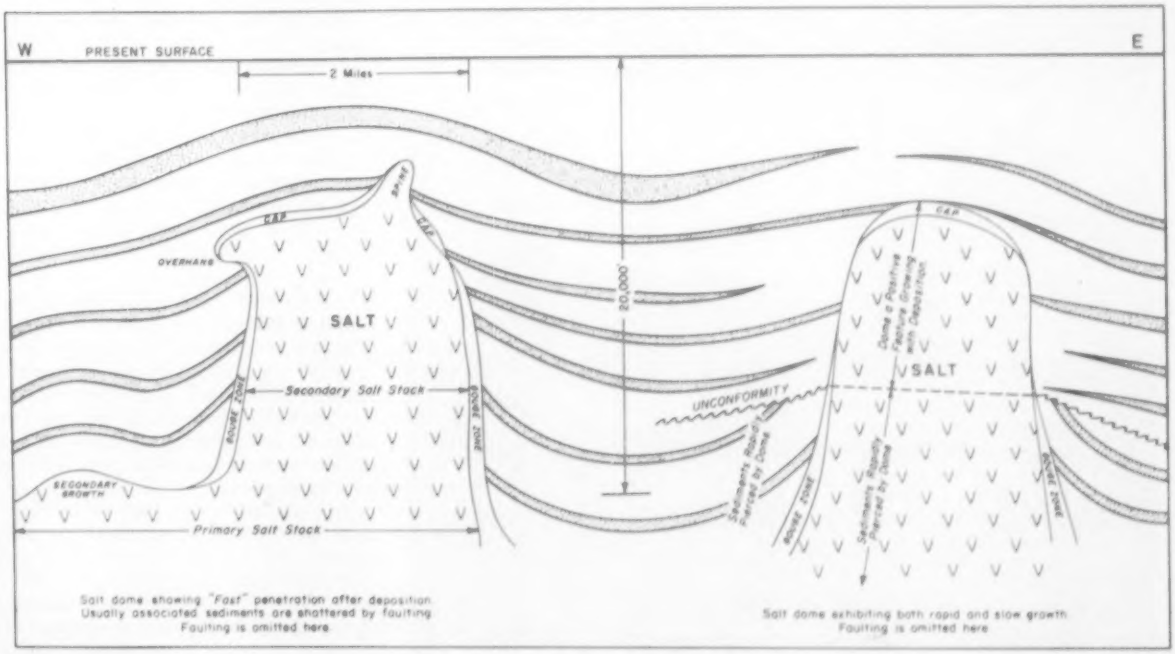
Eocene: Jackson formation, Cockfield formation, Cook Mountain formation, Sparta formation, Cane River formation, Wilcox formation, Midway formation.

All of these sediments dip generally southward toward the gulf at rates depending upon depth and location. The sediments are predominantly unconsolidated sand and shale, but limy sediments are found in numerous localities in restricted parts of the stratigraphic section. The Heterostegina ("Het") lime of the Anahuac formation is quite often found developed into the reef-type facies associated with salt domes and in extreme southeastern Louisiana the Het lime blossoms into a full-fledged reef structure. Generally speaking, the Miocene and younger sediments are of prime interest south of a line drawn from New Orleans west to New Iberia and southwest to Cameron (Fig. 1). Northward from this line the Oligocene and Eocene sediments assume a more predominant role in exploration.

Primary Gulf Coast Structures

Of course, salt domes are the most widely known gulf structures. They consist of salt masses of varying diameters which have pierced overlying sediments in rising from depth to various distances from the surface of the earth. A general classification widely accepted is the salt domes rising from within 0-5,000 ft. of the present earth's surface are shallow domes, from 5,000 ft. to 10,000-ft. depths they are re-



RATES OF GROWTH and other salt-dome features. Notice that the unconformity serves to trap oil on the flank of the right dome. Fig. 3.

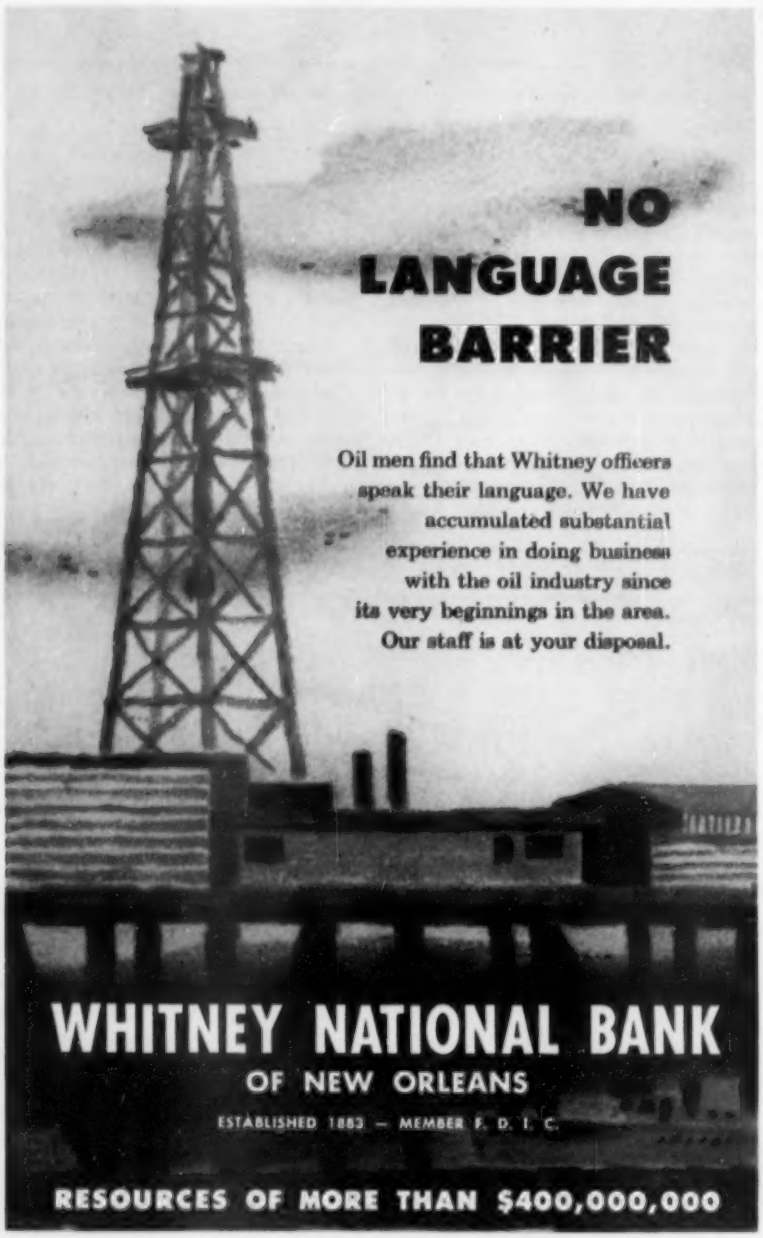
ferred to as intermediate-depth domes, and any salt structures on which salt lies below 10,000 ft., or is suspected to be the cause at great depth, are called deep-seated salt domes.

Although broad general characteristics can be ascribed to all salt domes, in actuality, each dome has a background and complexity unique unto itself. They vary in their times of maximum growth, speed of growth, forms, associated sedimentation, faulting, unconformities, etc. It is a dangerous fallacy to assume after becoming well acquainted with one salt dome that you can ascribe many of its characteristics to another salt dome (Fig. 3).

Although most South Louisiana oil and gas production is associated with salt uplifts, a considerable amount has also been found related to structures along regional faults. These faults are normal and downthrown to the south. Oil and gas production is found in low-relief anticlines on the down side of these faults.

The closures appear to have been caused by slumpage of sediments on the downthrown block into the fault plane. The closures usually migrate southward with depth at the same rate as the fault trace. Usually, the sediments on the downthrown side of the faults are thicker than on the north upthrown block indicating the faulting to be contemporaneous with deposition. There are also strong indications that the dip on the fault planes decreases with depth and approaches parallelism with the dip of the formations.

The regional faults are present throughout the Louisiana Gulf Coast but have been well delineated only in the upper Gulf Coast. Regional faults are not as abundantly well defined along the lower Gulf Coast due to regional distortion caused by salt domes, the greater difficulty of long range electric-log correlation in the Miocene sands, and confusion added by interrelated field faults.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Interrelationship of Primary Structures

One of earliest interrelationships of geologic structure noted in the Gulf Coast was the alignment, or trend, of the well-known Five Island salt-dome group. These shallow, piercement salt domes are aligned north-south through Vermilion and Iberia parishes. They all have topographic relief and hence were recognized easily by surface workers in the Louisiana Gulf Coast. It was theorized that these five salt domes arose from a common salt ridge, but later seismic data did not support this theory.

With much more geologic data now available, it still appears that instances of salt ridges can be cited. They appear as an alignment, or trend, of salt uplifted structures. Examples of salt ridges often cited are such fields as Shuteston - Cankton, Tigre Lagoon, Delta Farms-Barataria and others. The salt ridge idea should be kept in mind in the exploration of the Louisiana Gulf Coast.

Another structural feature often noted with shallow, piercement salt domes, and possibly related to salt ridges, is a prominent nosing of structure off one flank of the dome. This nosing feature often extends production an abnormal distance off the flank of a shallow piercement dome. This nosing feature is often referred to as a secondary uplift with the shallow piercement dome the primary feature. Such relationships tend to lend support to the salt ridge concept of salt domes. Salt uplifts along a ridge appears to have one primary shallow piercement dome trending off to deeper - seated salt uplifts on two sides. It is very possible that such salt ridges had their genesis in a zone of weakness present in the overlying sediments caused by faulting or a favorable density contrast in overlying sediments.

Oil traps . . . Much attention has been given to flank-sand pinchout traps in the past few years of salt-dome exploration. As the name implies, these struc-

tural-stratigraphic traps are caused when sands off the flanks of salt domes feather out some distances from the salt dome but are still close enough to be affected by the uplifting action. At the present stage, this type of salt-dome exploration is difficult for geologists because the area of sand pinchouts is difficult to predict. However, geologists can point out particular salt domes and dome flanks most favorable for sand-pinchout accumulation. At the present stage, some dependence must be placed on luck. On a number of salt domes, many successful deep flank tests have been drilled which have encouraged additional flank drilling by other operators.

The important point revealed by the high degree of success on these dome flanks is that any leases held on the flanks of a salt dome are prospective. On such leases and under these exploratory conditions, the only acreage definitely condemned by a dry hole is that acreage equal to the area covered by the hole. A well only a short distance away from a dry flank test may find an oil or gas-bearing sand pinchout. Extensions of production by these flank tests is often comparable to finding a large oil field in other areas.

There are some indications that gentle anticlinal folds have been formed in the gulf geosyncline as a prelude to future mountain building. This folding is subdued and trends at right angles to the coast line. The folds are particularly noticeable in the upper Gulf Coast where correlations are better and sharp salt uplifts do not wharp the regional concept. Many of the upper Gulf Coast fault-line field structures are believed to be directly attributable to north-south anticlines or nosings being cut by regional faults. This is what provides the east and west closure on the fault line structures and accounts for the alignment of many of these fields along a north-south as well as an east-west trend. A slight amount of regional eastward tilting has made the east flank of these structures steeper than the west.

Gulf Coast geologists have realized the importance of reconstructing geologic history in exploration and exploitation work. Unconformities are recognized as being very prevalent throughout the Louisiana Gulf Coast section. In salt-dome exploitation, the age of maximum salt uplift is important in field development. Once an intimate knowledge of the salt-dome history is acquired, wiser suppositions can be made as to the most prospective areas on the salt domes. A closer study of the periods of salt-dome growth will reveal which portion of the stratigraphic section of the area is most prospective. In exploration geology, much emphasis is given to the relation of stratigraphy to geologic history. The basis of exploratory geology is still to first determine whether the stratigraphic section is worthy of exploration.

Delineating Prospective Areas

Of course, for petroleum geologists, the first job is always to find prospective areas for oil or gas production. In the previous paragraphs we have tried to give a very basic concept of what is involved in Louisiana Gulf Coast geologic structure. Now, let's see, in a general manner, how this knowledge is employed.

In the upper Gulf Coast, much exploration is done on an east-west trend with the known regional faulting. Taking into account the age of the faulting and the stratigraphic section to be explored, attempts are made by the use of geophysics or subsurface geology to find closures along the faults. If closure is found, a study is made of the most prospective stratigraphic section for the closure and the initial well location made accordingly. There is little use in drilling a Cockfield formation test where the Frio formation is the only prospective formation and vice versa. The age of the fault determines whether accumulation is likely in the

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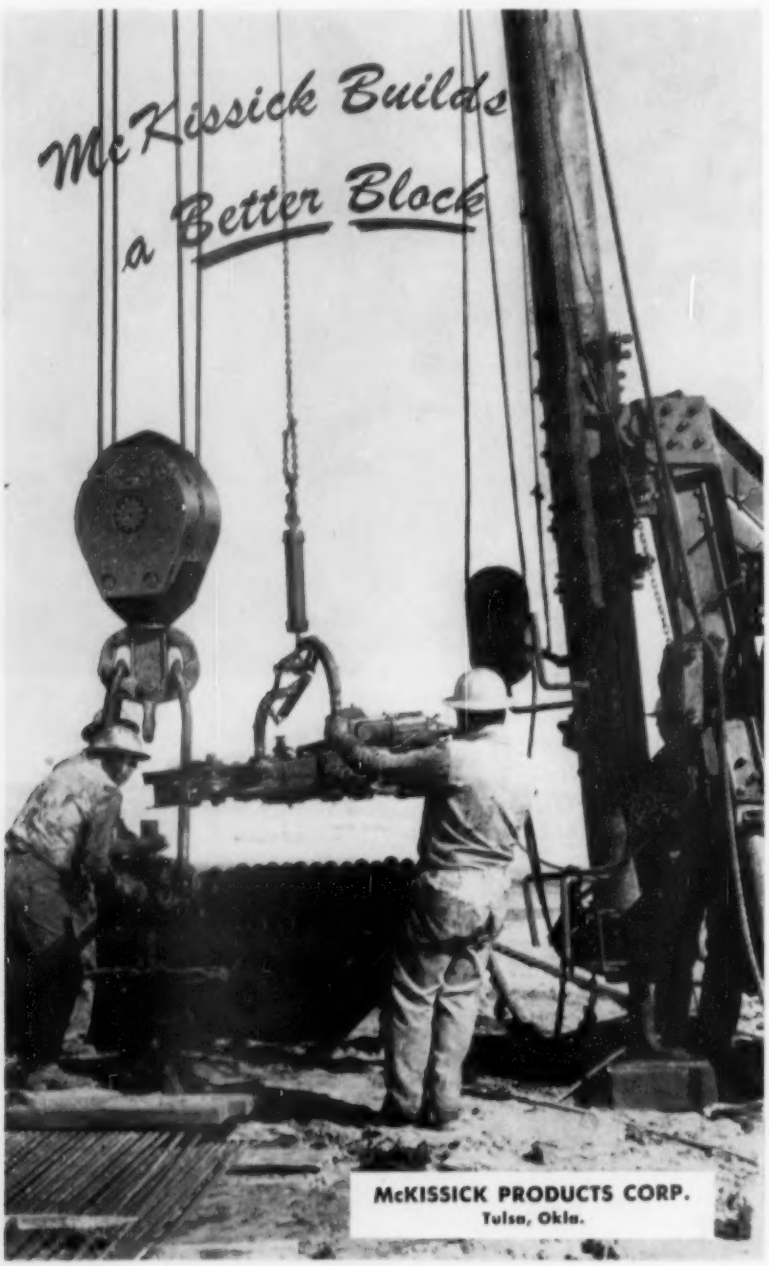
prospective formation along the fault. Hence, to summarize, regional faults are played east and west along trend.

In addition, particular attention is given to the area north and south of a known field in the upper Gulf Coast regional fault trend. The fields often appear to be the result of north-south nosings traversed by normal, tensional regional faults. Thus, when one field is found emphasis should be given to the area north and south of the field in an attempt to find the same nosing feature traversed by another regional fault.

In the near future, much more attention will be given to exploration along regional fault trends in the Miocene area and to deep, buried fault trends. Much study is now being given to studies of the hinge lines of formations. Regional faults are often associated with the hinge lines. Exploration along Miocene regional faults is carried out in much the same manner as in the regional faults is carried out in much the same manner as in the upper Gulf Coast.

Buried fault structures have been found in the Louisiana coast area. By buried, we wish to give the implication that the fault structures are buried beneath an old erosional surface. As a consequence, these structures are not readily apparent in shallower beds and can easily be passed over by reflection seismic surveys and regional subsurface mapping. For instance, a slight nosing of structure on a bed mapped at a depth of 10,000 ft. may indicate a closed structure at 13,000 ft. below an unconformity at 11,000 ft. The reflection seismic surveys have difficulty delineating this type of structure due to large and small unconformities and faulting confined to depth. Exploration for this type of feature requires very close cooperation between geologist and geophysicist. The geologist should point out the prospective area and problems involved and the geophysicist should interpret his data in the light of this information with constant consultations with the geologist on interpretation of data.



Flank production . . . In the exploration of the flanks of known salt domes, the following general ideas are held in mind. A lot of the production seems to be found on the north flank of the salt domes. This may be due to the regional south dip of sediments placing the north flank at the highest structural point which, disregarding faulting, is the north flank. So, if a choice can be made, the north flank of piercement salt domes appears most prospective.

In the search for salt-dome flank-sand pinchouts, consideration has to be given to the age of uplift. If the salt pierced blanket-type sands, that is, grew mostly after the sands were deposited, there is little chance of finding sand pinchouts. As one example we would cite West Cote Blanche Bay dome in Vermilion Parish. If the dome grew much of the time contemporaneous with deposition, many flank-sand pinchouts can be anticipated. As an example we would cite Lake Washington dome in Plaquemines Parish.

Fault traps on the flanks of domes or prospective nosings off the flanks of a dome can only be found by detailed subsurface mapping or seismic survey. The nosings off piercement domes are most often found on the flank on trend with structural elements in the vicinity; that is, if a salt structure lies east and west of the dome, a nosing may be anticipated on either the east or west flank. As mentioned previously, this type of a feature may be related to the salt ridge anticline theory. Wherever salt-dome ridges are indicated, the area of trend is always suspect. Examples of such possible trends are Hackberry-Big Lake-Sweet Lake domes in Cameron Parish and Fausse Point-Lake Chicot field in Iberia and St. Martin parishes. Both of these structural elements appear to be unfinished.

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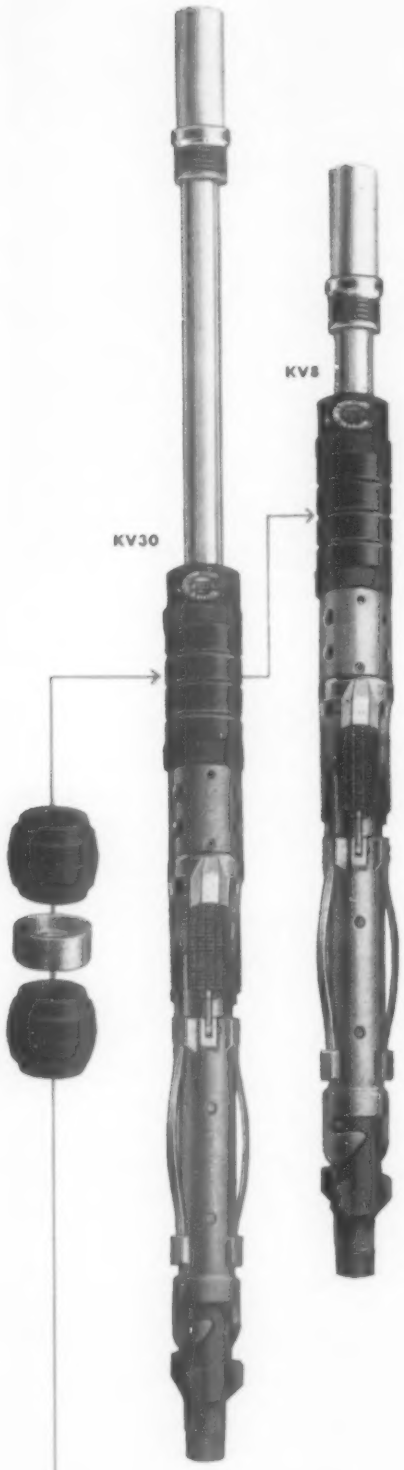

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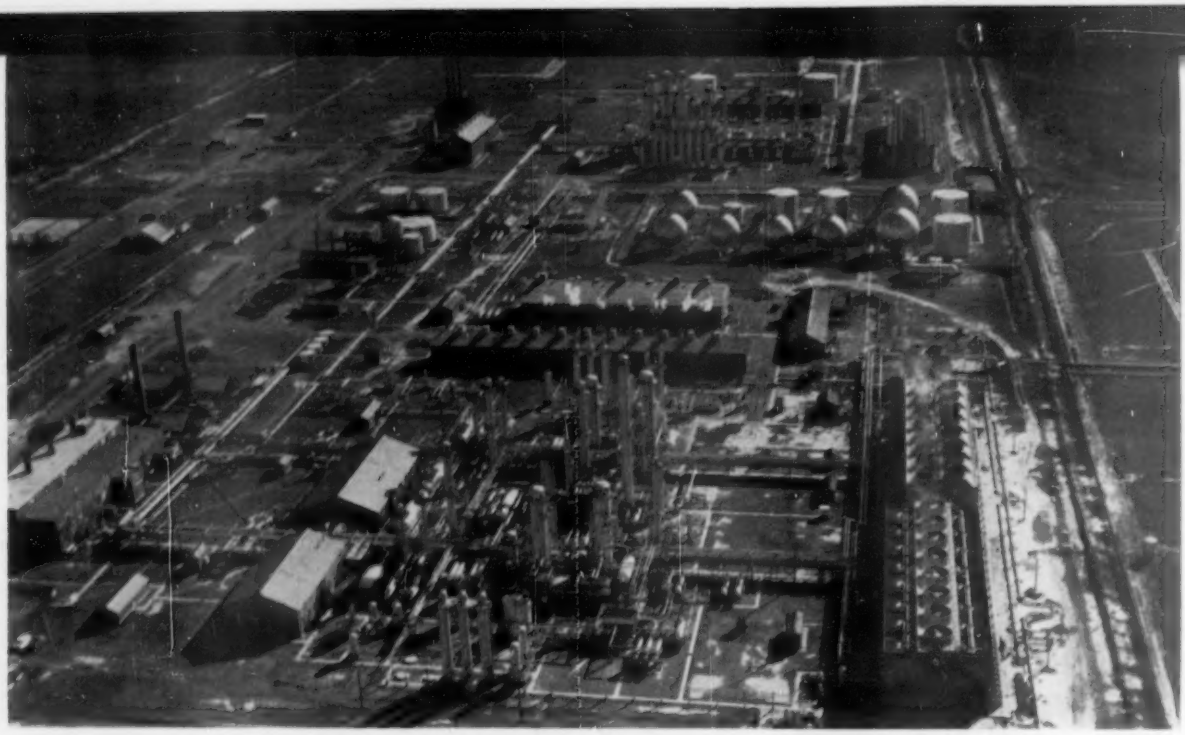


KATY CYCLING PLANT is the largest field-gas processing unit in the United States.

Texas-Size Cycling Operation

Katy gas field is one of the country's largest gas-condensate reserves; cycling plant processes 550 M.M.c.f.d. of gas to produce 24,000 bbl. of products.

by John J. Carter

LOCATION MAP, Katy field. Fig. 1.

THE cycling operation in Katy gas field is recognized throughout the petroleum industry as one of the world's outstanding conservation projects.

The field, which is located 30 miles west of Houston (Fig. 1), is one of the largest single gas-condensate reserves in the country. It includes over 30,000 productive acres, in which production is obtained from a 1,200-ft. stratigraphic section of the Cockfield (or Yegua) formation.

This section is comprised of 6 major sand zones which include 13 individual reservoirs ranging in depth from 6,250 to 7,450 ft. Cycling operations are currently under way in eight of the reservoirs.

Operations . . . Natural gas is produced from the reservoirs to a high-pressure gasoline plant where the liquefiable components of the gas are extracted. Residue gas composed primarily of methane is returned to the reservoirs.

The gas production rate to the plant averages almost 550 million cubic feet per day, from which over 24,000 bbl. of liquid products are extracted.

The processing plant is the largest cycling plant in the United States, and based on the volumes of liquids recov-

Author is with Humble Oil & Refining Co., Houston. Paper presented at 1956 T.P.R.C. conference, College Station, Tex.

ered, the plant is the largest field-gas processing plant in the country.

Early Project

The Katy cycling project was one of the early gas-cycling operations to be undertaken, and at the time of its inception it represented one of the largest unitization projects. There was little experience available in large-scale gas-conservation projects at the time of initial planning of the program; consequently, a large amount of effort was required to initiate the cycling operations.

Throughout the history of the project, the willingness of the various interested parties to cooperate in the common cause of developing a sound, efficient operating program is very much in evidence.

The area surrounding the field began to receive considerable attention from exploration geologists in the early 1930's. In 1934, the owners of leases located in a 4-sq.-mile area near the crest of the field structure pooled their interests and selected Stanolind Oil & Gas Co. as operator of the unit to drill an exploratory well. This initial well was completed in February 1935 and is credited with the discovery of the 13 reservoirs comprising the field.

While at the time of completion of the discovery well it was realized that a major gas-condensate reserve had been discovered, the operators owning leases in the area were unable to perform additional drilling because there was no market for the natural gas.

In 1938, a small gas sales market became available which permitted an accelerated development program, and by 1940, 11 wells had been completed in the field proving approximately 11,000 acres productive.

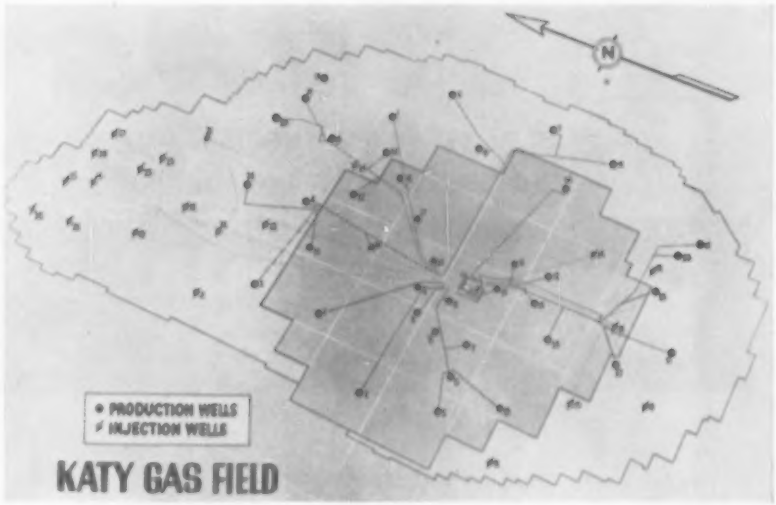
Cycling started . . . In 1940, the producing capacity of the field had greatly exceeded the market demand, and the wells were producing at very restricted rates. In order that the operators in the field could realize incomes commensurate with their investments in the field, plans were made to cycle the gas-condensate reservoir.

This permitted the recovery of the liquefiable components of the gas without the need for a sales market to permit disposal of the produced gas without waste.

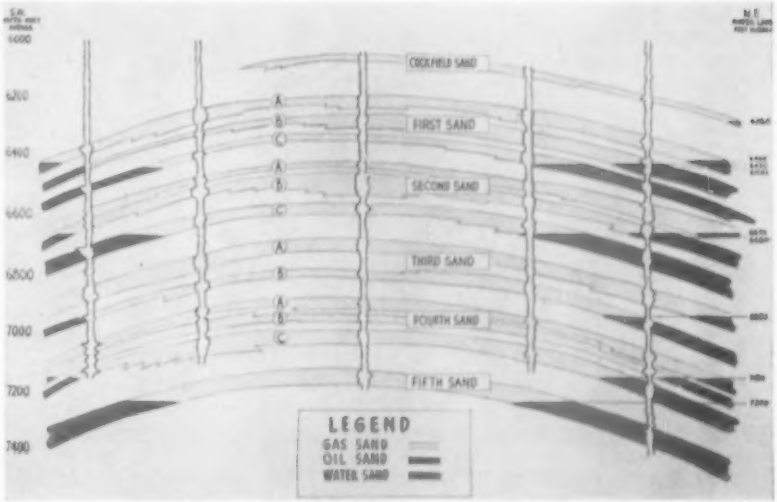
During the 2-year period following the decision to cycle the field, the necessary steps were taken to make the cycling project possible. At that time there were 13 operators owning leases inside the proved productive area. These operators agreed to unitize the leases in the productive area to permit operation of the acreage as a unit (Fig. 2) with Stanolind designated the operator.

The consent of the royalty owners was obtained to unitize the field and to perform cycling operations. Nine of the lease owners elected to participate in ownership of the cycling plant, selecting Humble Oil & Refining Co. to be the plant operator. The plant owners then entered into a processing agreement with the owners of the unit.

With the preliminary steps completed, a cycling plant capable of processing 250 million cubic feet of gas per day was constructed, and cycling was initiated on January 1, 1943.



UNITIZED AREAS, Katy gas field. Fig. 2.



FIELD STRUCTURE is that of a large domal anticline. Fig. 3.

Area extended . . . Drilling operations performed during 1942 and 1943 showed that the 11,285 acres in the unitized area represented less than half of the total productive area. The development work, performed on voluntary 800-acre units, proved over 17,500 acres to be productive outside the unitized area.

This additional acreage which almost completely encircled Unit 1 was unitized under separate unitization agreements with Humble designated as its operator. To accommodate the additional gas which became available the cycling plant was enlarged in capacity to over 500 million cubic feet of gas per day.

The lease owners in the second unitized area, designated as Unit 2, were permitted to share in the ownership of the cycling plant. On October 1, 1944,

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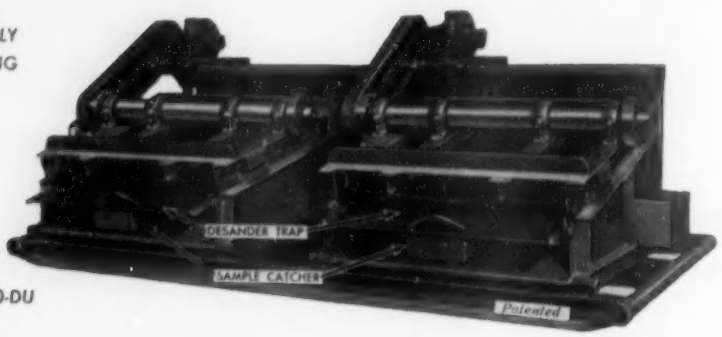

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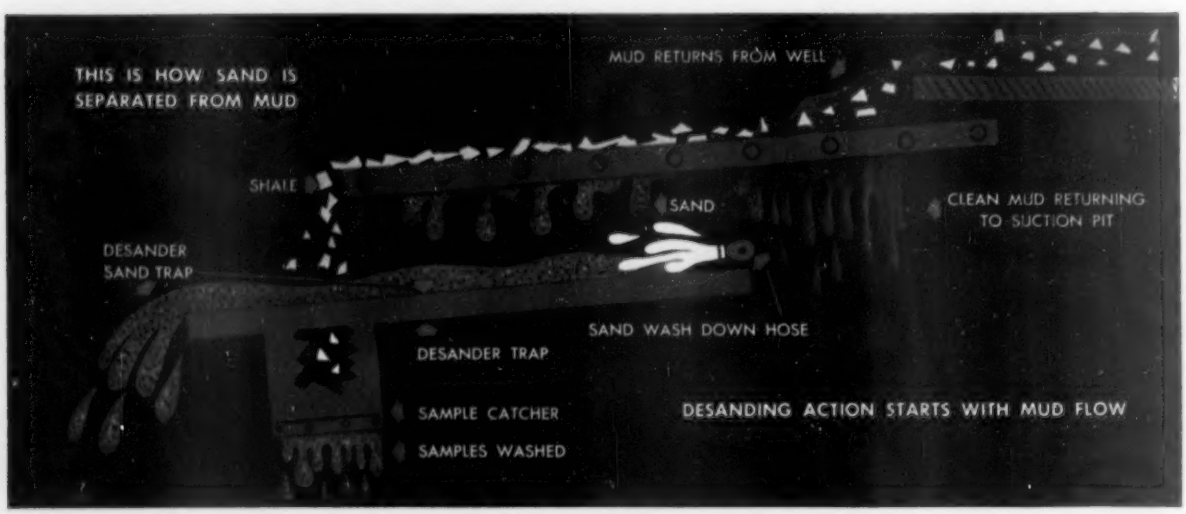

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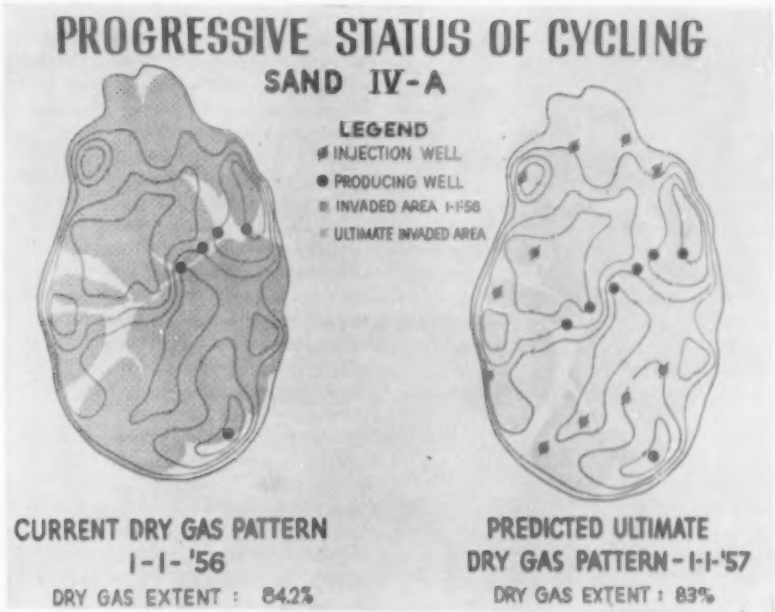
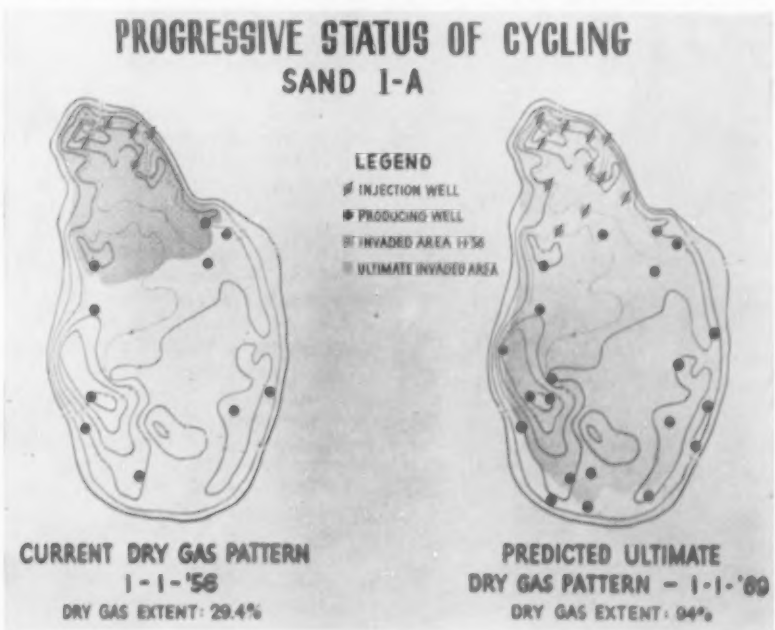


PERFORMANCE OF SAND IV-A, first zone to be cycled in Katy field. Fig. 4.



SAND I-A CYCLING PROGRAM is good example of procedure currently being used. Fig. 5.

Humble became the operator of the entire cycling project.

During 1945 and 1949, major additions to the cycling-plant equipment were made to improve product-recovery efficiency and the control of product specifications. The additions made in 1945 consisted of fractionating equipment added to the existing plant equipment to permit recovery of commercial propane, isobutane, and normal butane.

In 1949 additional facilities were added to operate in parallel with the existing facilities to increase recovery of the lighter hydrocarbons, namely, propane and ethane.

31 owners . . . At the present time there are 31 companies and individuals sharing in the ownership of the project. Each of the owners has a voice in the operating practices for the field and plant through its representatives on various advisory and administrative committees of the project. Each party markets its share of the products recovered by the plant.

TEXAS-LOUISIANA
NEW ENGINEERING TECHNOLOGY

In addition to the gas-cycling operations in the field there are oil operations of considerable importance. The initial oil completion was made during 1943. At present there are 92 oil wells in the field, producing approximately 1,600 bbl. of crude oil daily.

The oil-producing operations are not connected with the cycling project, and the oil rights are not unitized. However, as a conservation measure the gas-cycling plant does gather and process the casing-head gas produced by the oil wells.

The Katy Cycling Plant

The cycling plant is actually three plants operating in parallel. Plant No. 1 is the initial plant installation made prior to the start of cycling in Unit 1. Plant No. 2 was installed when Unit 2 was formed to provide the capacity necessary to process the additional gas that became available at that time. Plant No. 3 was installed in 1949 to increase recovery efficiency, particularly of propane and ethane products.

Operations . . . The cycling plant utilizes a high-pressure oil absorption and steam-distillation process to extract and recover the liquefiable products. It is designed to recover commercially pure propane or an ethane-propane mixture, isobutane, normal butane, natural gasoline, and a heavy naphtha product.

Blending facilities were installed in 1944 to permit the production of aviation-grade gasoline for the armed services. During World War II, over 96 million gallons of aviation gasoline was produced by the plant. The use of the blending facilities has long been discontinued and all of the gasoline produced is being marketed as an unleaded base stock.

The gas from the Katy field producing wells is gathered and transported to the cycling plant through a gathering system operated at a pressure of from 2,000 to 2,200 psi. The gas enters the plant and is cooled and reduced in pressure to 1,800 psi. before entering the inlet scrubbers.

Gas from the scrubbers then passes to the high-pressure absorbers. Residue gas from the absorbers is compressed from 1,800 to 3,150 psi. for return through injection wells to the reservoirs being cycled.

Size of units . . . The cycling plant has a number of interesting features, the most significant of which is its size. It utilizes 15 absorbers, 9 reabsorbers,

10 stills, and 9 fractionating columns. The circulation rate of the absorption oil through the absorbers and reabsorbers is 267,000 bbl. per day.

Steam for power and processing is supplied by eight high-pressure boilers and three low-pressure boilers. The total steam capacity of these boilers is 610,000 lb. of steam per hour. Electrical energy is developed by four turbine-driven generators which have a capacity of 9,000 kw.

For injection of gas and recompression requirements in the plant, over 22,000 compressor horsepower is available. For chilling of absorption oil, 5,300 tons of refrigeration capacity is used. There are five cooling towers serving the plant having a total heat load of over 900 million B.t.u. per hour. The water-circulation rate through these cooling towers is in excess of 100 million gallons per day, and the evaporation loss is over 2 million gallons per day.

Water for plant use is provided by six water wells owned by the plant, each having a capacity of 500 g.p.m. Considering all of the prime movers in the plant the total power available is almost 80,000 hp.

Pipeline operations . . . The cycling plant operates it own pipeline to the Houston industrial area and has storage and dock facilities under lease on the Houston Ship Channel. The pipeline delivers 14,000 bbl. per day of naphtha, natural gasoline, isobutane, and normal butane to junctions near Houston where the various refineries and plants which purchase the products accept delivery.

The ethane-propane product is transported by two pipelines owned by the purchaser of the products. Extensive tank-car and tank-truck loading facilities are maintained near the plant, but at the present time only a small percentage of the products is being delivered by tank cars or trucks.

Storage wells . . . Two storage wells have been provided to serve the plant, one of which is used for butane storage and the other for ethane and propane storage. Both are completed in one of the smaller gas reservoirs of the field. The reservoir being used was selected because of its good sand characteristics and because of its small size which will permit cycling to be delayed until near the end of the field cycling operations.

The stored products are injected and reproduced as liquids. Over 3 million barrels of products have been injected into the two wells and 2.1 million barrels reproduced. The volume in storage has been as much as 1.3 million barrels since the storage project was initiated in 1949.

The storage project has been very efficient with only a small amount of contamination of the stored products by reservoir gas. The stored products are reproduced through conventional field-type separators located at the plant where the contamination is flashed off as a vapor which is processed in the plant along with other low-pressure gas. It has not been necessary to reprocess the storage-well production through the plant.

The personnel of the Katy cycling plant, which also performs the field producing operations, total 255 in number. An outstanding safety record has been amassed by the personnel of the plant, there having been no lost-time accidents in over 7 years. This period represents almost 4 million man-hours of work without a disabling injury.

Katy Gas Field

Katy gas field includes at present 31,471 productive acres and has approximate dimensions of 10 miles in length and 6 miles in width. As with the cycling plant, the most significant feature of the field is the large scale of the operations in progress.

Since cycling was initiated in January 1943 the average production rate has been 471 million cubic feet of gas per

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day, and the current rate is approximately 540 million cubic feet per day.

To accomplish the cycling operations now in progress, only 59 wells are being utilized, of which 37 are gas-producing wells, 20 are gas-injection wells, and 2 are products-storage wells. The average per well producing rate is approximately 15 million cubic feet per day and the rate of some wells has ranged up to as high as 38 million cubic feet per day against 2,000-psi. line pressure.

Field structure . . . The Katy field structure, which is a large domal anticline, Fig. 3, is unusual for the Gulf Coast area because of the complete absence of faulting within the productive limits. Another unusual feature of the structure is that its development evidently occurred as a result of subsidence of the flanks rather than uplift of the crest of the structure.

The structural closure indicated for the six productive zones of the Cockfield formation ranges from 105 to 320 ft. The six sand zones are designated, in the order of increasing stratigraphic depth, the upper Cockfield Sands I, II, III, IV, and V.

Each of these zones, with the exception of the upper Cockfield and Sand V, is composed of 2 or more sand members, providing a total of 13 individual reservoirs.

The producing sands of the 13 reservoirs are, in general, well developed and have high permeabilities, with the average permeabilities of the individual reservoirs ranging from 250 to 2,820 md. The sands are reasonably uniform in characteristics, although considerable variation in thickness exists in the individual reservoirs.

Ten of the 13 reservoirs contain only gas while 3 contain gas and associated oil. The oil-productive acreage is confined primarily to the north end and eastern side of the field. The oil reserves are typical rim-type accumulations having thin oil columns.

Cumulative production . . . During the 13-year period from January 1, 1943, when cycling was initiated, to January 1, 1956, a total of 2.2 trillion cubic feet of gas was produced to the cycling plant. Sand IV, which is composed of three separate reservoirs, was the first sand to be cycled in the field, and for a considerable period of time it provided most of the production to the plant.

As cycling operations in Sand IV neared completion, initiation of cycling in other sands became possible and the production from these other sands has steadily increased. Cumulatively, Sand IV has contributed 58.4 per cent of the production; however, during 1955 it produced only 21.7 per cent of the total field production.

Of the 2.2 trillion cubic feet of gas that has been produced to the cycling plant, 1.9 trillion cubic feet, or 85 per cent of the produced volume, has been returned to the reservoirs being cycled. Only 6.8 per cent of the produced volume has been sold and 8.1 per cent has been consumed in plant and field operations or lost through process shrinkage.

Injection volumes . . . The volume of gas that is injected in each reservoir being cycled is approximately proportional to the production of that reservoir. Attempts are made to have injection volumes approximately equal to the production for each reservoir in order that the reservoir pressures can be maintained at near the original levels.

This practice requires that a volume of gas be produced from a reservoir not being cycled to replace at least part of the gas consumed in maintaining the plant processes and sold. This makeup gas is provided at Katy by a reservoir which because of poor sand conditions is not suited for cycling.

The reservoir is produced at very low withdrawal rates utilizing its nat-

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ural water drive to maintain the reservoir pressure.

In the Katy cycling operation the gas returned to the reservoirs is injected as far as feasible from the producing wells. This injected gas moves from the area of the injection wells toward the producing wells in the form of an expanding bubble. When the dry-gas front reaches a producing well a decrease occurs in the liquid content of the produced gas as the well begins to produce the dry injected gas.

The usual procedure is to recomplete the producing wells to service in other reservoirs as soon as practical after invasion by dry gas occurs to minimize the amount of dry gas that must be processed.

Model studies . . . In order that the cycling program which will provide the greatest pattern efficiency can be determined for the reservoirs at Katy, potentiometric model studies are conducted for each reservoir periodically.

By duplicating reservoir behavior in a scale model of each reservoir by electrical analogy, it is possible to determine which wells should be employed in cycling each reservoir and the producing or injection rates that should be used to provide for maximum recovery of the wet gas reserves.

Cycling status, Sand IV . . . The first zone to be cycled in Katy field, Sand IV, is composed of three reservoirs which have been cycled simultaneously, with the wells utilized having in some instances perforations opposite all three reservoirs. A periphery-to-center sweep pattern was employed which provided for injection wells to be located around the outer edge of the field and the producing wells to be located across the crest of the structure.

The performance of the top reservoir of this group, Sand IV-A, has been representative for the zone, Fig. 4. With the cycling operations essentially complete in this reservoir current model studies indicate that a pattern efficiency of 84.2 per cent has been achieved.

It was predicted from early model studies that the ultimate pattern efficiency would be 83 per cent, thus showing that the early model studies were successful in accurately predicting reservoir behavior. Pattern efficiencies of 79.3 per cent and 88.6 per cent have been achieved in the other two reservoirs of Sand IV.

The use of the periphery-to-center sweep pattern in Sand IV resulted in satisfactory displacement of the reservoir gas with injected residue gas. However, studies conducted after cycling was initiated in the zone indicated that greater cycling efficiency would be possible through use of end-to-end sweep patterns. These studies also indicated that the cycling would be improved in efficiency if each reservoir were cycled separately with no wells completed in more than one reservoir at a time.

In view of the results of these studies the cycling procedure adopted for use in the reservoirs in which operations have recently been initiated has included use of end-to-end sweep patterns, and each of these reservoirs is being cycled individually.

Sand I-A cycling . . . The Sand I-A cycling program is a good example of the procedure currently being used. All of the injection wells are located at the north end of the reservoir and the producing wells are located through the center of the reservoir and at the south end (Fig. 5). With this cycling procedure it should be possible to achieve a pattern efficiency of 94 per cent for this reservoir which is somewhat higher than will be achieved in Sand IV.

In order that the progress of the cycling operations can be closely followed and so that data will be available for the necessary engineering studies to be made, very extensive testing operations are conducted in Katy field. A reservoir engineering staff in-

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cluding a subsurface-measurements and gas-testing crew is maintained in the field to perform and interpret the field tests and to develop proposed operating practices.

In a multiple-reservoir field such as Katy, one of the potential problems that exists is that of interreservoir communication resulting in migration of gas from one reservoir to another. The problem can be very serious in a cycling operation where communication can disrupt the cycling patterns in the reservoir by permitting dry gas from one reservoir to migrate into the wet zone of another reservoir or wet gas to migrate into a dry-gas zone.

To detect any interreservoir communication developing, detailed temperature traverses are made in each Katy well periodically. To date, communication has been detected in the well bores of 13 wells. The communication has been successfully repaired in each case by squeeze cementing between the individual reservoirs involved.

Experience indicates that large net withdrawals from any of the reservoirs prior to completion of cycling operations would increase the occurrence of interreservoir communication as a result of the greater differentials in pressure that would result between the reservoirs.

Pressure measurements . . . These are conducted in all of the Katy wells periodically to determine the effectiveness of the injection program in maintaining pressures in the reservoirs being cycled. Periodic wellhead liquid-content tests are run on each well to permit study of the retrograde behavior of the reservoir gas and to permit location of the dry-gas fronts whenever the fronts reach producing wells.

These content tests provide a check against the potentiometric model study predictions by permitting comparison of the actual dates of dry gas invasion in the producing wells against the dates predicted from the model studies.

Based on the reservoir engineering studies that have been conducted, the cycling operations in Katy field should be completed in 1975.

The good performance of the reservoirs to date under cycling operations and the careful attention being given to the maintaining of the most effective operating program should insure that the remainder of the Katy condensate reserve will be recovered in a very efficient manner.

By the time that cycling operations are completed, an efficient program will have been developed to provide for the maximum recovery of the dry-gas reserve which will exist at that time in the reservoirs that will have been cycled.

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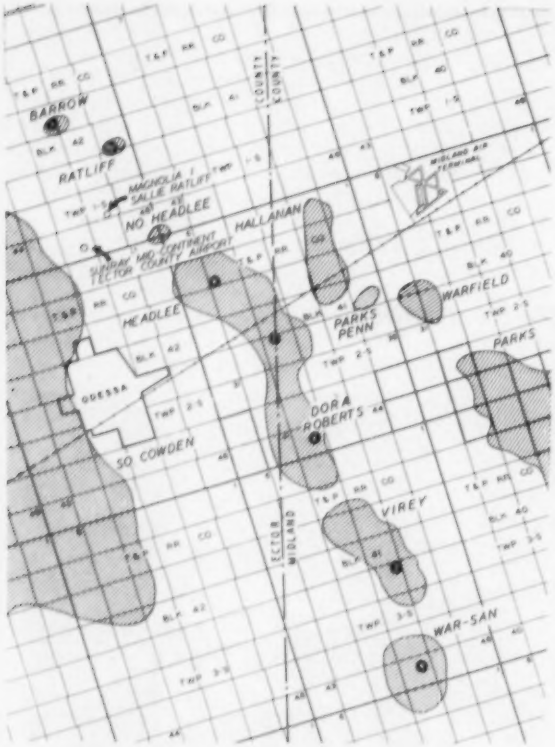


Twenty rigs are drilling in Dora Roberts-Headlee trend of Midland and Ector counties. Star and circles are Ellenburger discoveries of each area. Sunray and Magnolia extension attempts north of Odessa found water in the Ellenburger. (Map courtesy Midland Map Co.)

Dora Roberts Trend Is Delivering as Expected

by Carl Hoot
District Editor

THE so-called Dora Roberts Trend in West Texas is holding up to all early expectations. And a few extra bonus features have been found. There are no serious drilling problems; the Ellenburger pay runs from 100-500 ft. in thickness; many wells are being dually completed in the Ellenburger and Devonian; and above these formations are one or more prospective Pennsylvanian pay zones.

The trend now stretches 24 miles in length, from War San on the south to Barrow on the north, in Midland and Ector counties. This trend is shown on the accompanying map, with Ellenburger discoveries of each area located by a star and circle.

Operators say the outlook for additional drilling is good, but with few locations on the east side, because most fields have a steep east flank plus indications of faulting. Barrow and Ratliff are still one-well Ellenburger pools. North Headlee was opened by Woodward & Co. 1 Sallie Ratliff, a Devonian producer. Potential on the well was 633 bbl. a day from approximately 100 ft. of pay.

Woodward's test ran low on the Ellenburger, going into the formation at 13,703 ft., or minus 10,714 ft. Average oil-water contact at Headlee field is minus 10,526 ft., or a drilling depth average of 13,436 ft. However, a drill-stem test in the Ellenburger at 13,744-64 ft. recovered only a small amount of gas-cut mud, with no water.

Drilling progress . . . The two wells used for comparison (Table 1) were drilled by Texas Gulf Producing Co. on Roy Parks leases. The first well was drilled in June 1953 shortly after Headlee field was discovered, while the second was completed in May of this year. The wells are approximately 3 miles apart, and drilling conditions are fairly similar.

Total time on an Ellenburger well for the area has been cut approximately 40 per cent. Number of bits used has gone down from 172 on the early wells to 79 at present, while average footage per bit has increased from 77 to 166. The main saving in rig time is due to fewer drill-stem tests and less coring.

At present the practice is to drill to the Ellenburger, or to the Devonian if that is the principal objective, run electrical surveys, set pipe, acidize or fracture, and then test the pay section. The known pay sections above the Ellenburger or Devonian generally are not drill-stem tested.

South of the Midland-Odessa highway the Ellenburger is still the main objective. But operators say that north of the highway the Devonian is expected to be the best pay in future drilling.

TABLE 1—DRILLING PROGRESS—DORA ROBERTS AND HEADLEE AREA

	June 1953	May 1956
Location	Headlee field, Ector County	Dora Roberts, Midland County
Pay zone	Ellenburger	Ellenburger
Total depth (avg.), ft.	13,186	13,186
Day work rate, with drill pipe (avg.)	$1,175	$1,175
Day work rate, without drill pipe (avg.)	$1,100	$1,100
Rig-time distribution:		
Days on footage	79	41
Days on day work rate	49	34
Total days (spud to rig release)	128	75
Total number of bits used	172	79
Feet per bit, avg.	77	166
Geological data:		
Yates, ft.	2,924	2,812
Spraberry, ft.	7,985	8,030
Strawn, ft.	9,839	9,909
Devonian, ft.	11,476	11,528
Montoya, ft.	12,456	12,304
Simpson, ft.	12,646	12,512
Ellenburger, ft.	13,054	13,106
Casing program:		
Surface (13⅜-in.), ft.	356	303
Intermediate (8⅝-in.), ft.	5,958	5,964
Oil string (5½-in.), ft.	13,325	13,178
Mud program (average):		
Salt mud to intermediate casing seat; water to approximately 9,600 ft., then fresh water mud to total depth.		
Mud summary (average):		
Superior gel, tons		85½
Well gel, tons		19½
Salt, tons		38
Superior starch, lb.		2,500
Quebracho, lb.		3,450
Cello Flake, lb.		2,250
Santomerse No. 1, lb.		150
Driscose, lb.		650
Guartec, lb.		300
Graphite, lb.		4,400
Caustic soda, sacks		17
Soda ash, sacks		31
Lime, sacks		1
Strata fiber, sacks		86
Hulls, sacks		75
Bicarbonate of soda, sacks		8

Low-pressure gas sweep, plus fracturing . . . result:

Oil Recovery Increased 25 Per Cent

With 1 injection well and an average of 10 producing wells, the gas sweep has recovered in 5 years 115,000 bbl. of oil that would not have been recovered by natural depletion

by Ed McGhee
District Editor

LOW-PRESSURE gas injection and hydraulic fracturing have proved successful for Continental Oil Co. in increasing primary production in Boyle field, Starr County, Texas. After 5 years of injection of produced gas, Continental has increased oil recovery 25 per cent over indicated primary production. The project was carried out with a very small original investment since gas was injected directly from an existing system of uncompressed untreated casing-head gas. An average of 10 wells have produced in the project's life, and payout was good.

Boyle field's "J" sand reservoir is a typical South Texas stratigraphic trap formed by normal faulting (Fig. 1). The net oil-sand thickness is about 12 ft. Indicated primary production is about 1,000,000 bbl. of oil. For the area under Continental's leases, the primary recovery is indicated to be about 458,000 bbl.

This indicated primary production is only 13.8 per cent of the oil in place. But this is not too unusual for sand of the "J" sand type, which is shaly, has low permeability, and has a solution-gas drive.

Recovery project . . . Gas injection started early in 1951 when the pool had been producing only 6 years. Continental had recovered 13.5 per cent of the oil in place. Reservoir pressure was down to about 350 psi. and prospects were that the economic producing rate with natural depletion would be reached in about 2 years (Fig. 3). Frio sands in the South Texas area are often quite water sensitive, probably because of bentonitic clays in the shaly sands. This was the case in Boyle field, so water flooding could not be used as a means to increase recovery.

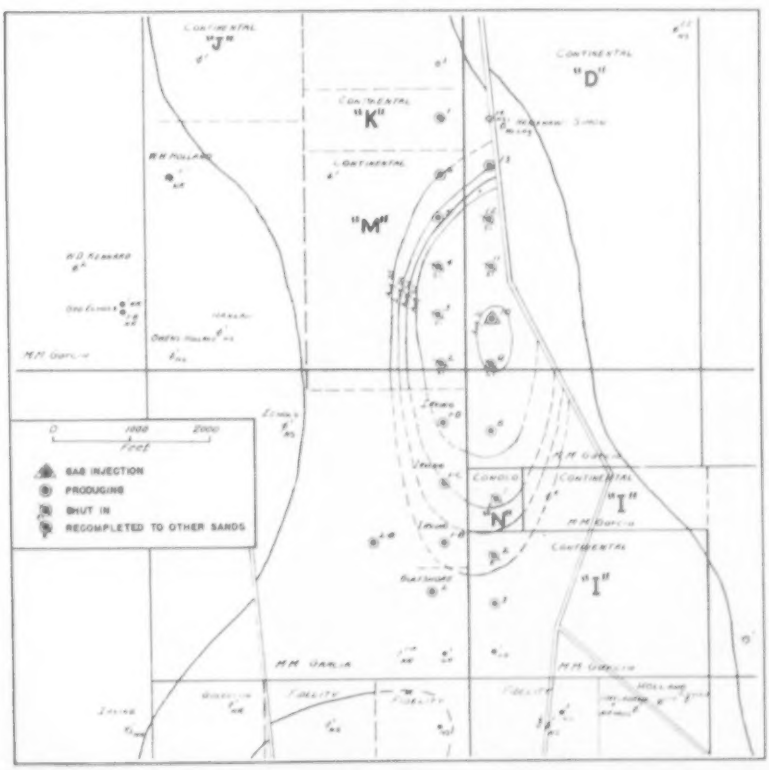
At the time injection of gas was started, the results were an immediate halt of the primary decline rate. However, by 1952, production began declining again at a slow rate as seen in Fig. 2. Then, in late 1952, a number of the producing wells were fractured. This boosted production rate to a level that held through 1954. Even though a slow decline started in 1955, production rate in the latter part of the year was still as high as it was at the time gas injection started, nearly 5 years before.

During this period of injection of low-pressure gas, Continental has recovered an additional 115,000 bbl. of oil from its portion of the field. Cumulative production has increased to 572,000 bbl., for a recovery of 17.2 per cent of the original oil in place, compared to the 13.8 per cent that would have been recovered by unstimulated production.

Gas injection is continuing in the reservoir and, although the number of producing wells is being decreased because of the advance of the gas, considerably more oil can be produced before economic depletion is reached.

Injected gas cycled . . . As shown in Fig. 2, about a year after gas injection commenced, the gas-oil ratio at the producing wells increased markedly. However, a large part of this gas was injected back into the reservoir. In order that the gas-injection program not suffer because of the gas produced from the sweep, it was necessary to obtain an oil allowable based on "net" gas, or produced minus injected gas. The Railroad Commission granted this in December 1952.

Further change in gas production rules was granted in 1954. Then, under an amendment to the allowable rule, "net" gas became the difference between total gas produced and gas



BOYLE FIELD "J" sand reservoir. Dated contours are positions of 10,000 cu. ft. per bbl. gas-oil ratio which show the general advance of the sweep from the single injection well. Fig. 1.

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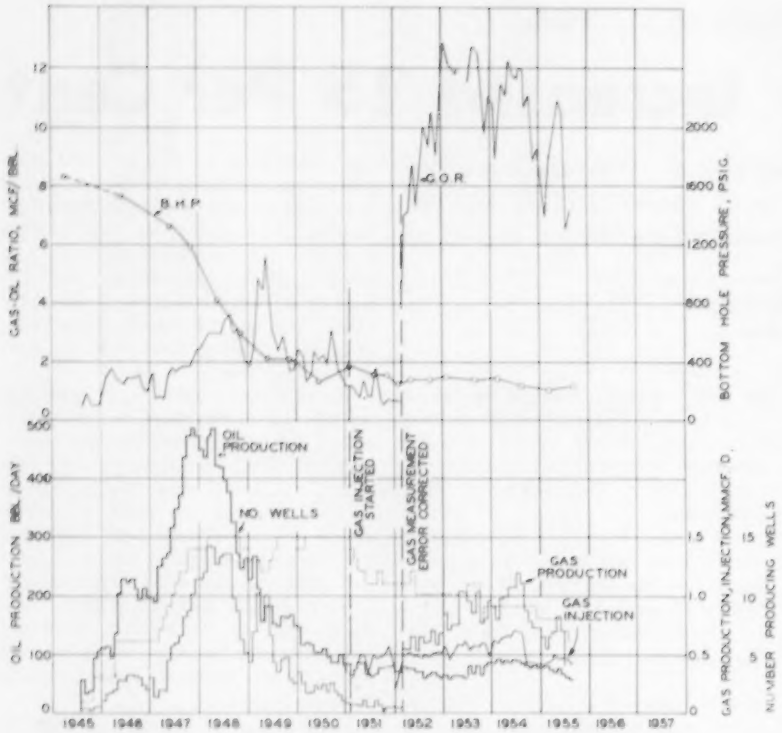


PRODUCTION AND INJECTION HISTORY. Gas injection has maintained reservoir pressure at about 250 psi. High gas-oil ratio is the result of producing flood gas. Fig. 2.

diverted to legal use. Almost all of the produced gas is gathered for liquid extraction.

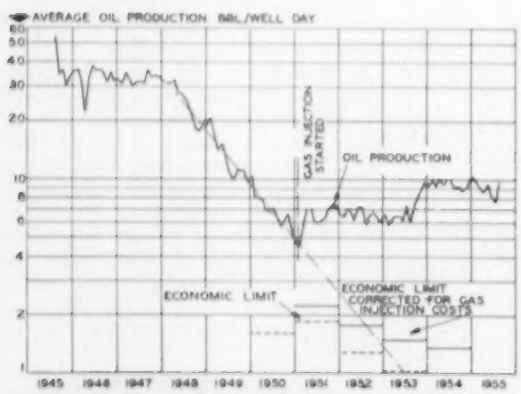
Gas displacement . . . Gas had been injected into the one injection well shown in Fig. 1 since January 1951. Cumulative gas injection has been 825,000 M.c.f. Initial injection rate was about 750 M.c.f. per day. In late 1954 this rate was reduced to 400 M.c.f. per day to determine whether the oil-production rate could be maintained and the channeling effect of the injected gas reduced. Fig. 1 shows the contours of reservoir gas-oil ratio of 10,000 which indicates the general advance of the gas sweep.

A great deal of the injected gas remains in the reservoir. Performance curves of the other volumetric reservoirs in the area not under pressure maintenance indicate maximum gas-oil ratio of between 6,000 and 10,000 cu. ft. per barrel. Assuming all produced gas above 10,000 cu. ft. per barrel is cycled injected gas, the volume of gas cycled is 365,600 M.c.f. or 44 per cent of the injected volume.

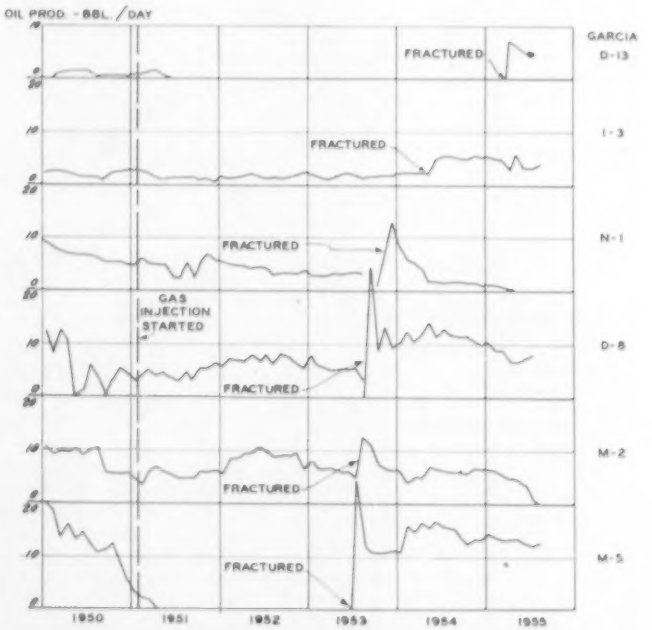
The remainder of the gas is probably in the swept gas. Assuming 12 ft. of net pay, or 18,400 bbl. pore space per acre, average pressure of 260 psig., average temperature of 160° F., and a compressibility factor of 0.96, the gas would cover an area of 268 acres. This compares with a planimetered area of 213 acres within the 10,000-cu.-ft. per barrel contour for August 1955 (Fig. 1).

As shown in Fig. 2, the average pressure of the reservoir has declined very slightly since gas injection began. No indication of edge-water movement has occurred.

Gas-oil ratio behavior has been greatly influenced by operational changes. It


AVERAGE OIL PRODUCTION BBL/WELL DAY
GAS INJECTION STARTED
OIL PRODUCTION
ECONOMIC LIMIT
ECONOMIC LIMIT CORRECTED FOR GAS INJECTION COSTS
1945 1946 1947 1948 1949 1950 1951 1952 1953 1954 1955

AVERAGE WELL PRODUCTION. Peak of development was in 1948. After that, the primary reservoir decline began. Gas injection halted the decline and fracturing boosted the average well production. Fig. 3.



HISTORY OF FRACTURED WELLS. Fracturing increased the rate of oil withdrawal and thus shortened the "tail-end" period of low-productivity, high-expense production. More oil resulted in some cases, such as Garcia M-5. Fig. 4.

showed an unrealistic decline prior to March 1952 because the meters failed to operate properly. The meters failed to detect gas produced between gas-lift cycles or "heads." This difficulty was corrected by the use of orifices. The reservoir gas-oil ratio has also varied as high-ratio wells were produced and shut in on occasion.

Effect of fracturing . . . In a few instances, the reserves have definitely been increased by hydraulic fracturing in this reservoir. The most notable example of this is Garcia M-5 (Fig. 4). However, the composite effect of fracturing on the reservoir appears to have been to maintain production at a level well above natural-decline production rate and thus shorten the "tail-end" period of low-productivity, high-expense operations.

Increased production shown from June 1953 to August 1955, in Fig. 2 coincides with the increases from fracturing in Fig. 4. Assuming a level producing rate of that period had fracturing not been done, the increase in oil production was 13,310 bbl. Therefore, most of the future lifting cost on at least this amount of oil has been saved by hydraulic fracturing. Further savings may possibly be realized by fracturing the two wells yet to be reached by the gas front, Garcia K-1 and M-6.

Reduced injection . . . Although oil production has declined somewhat since the date of lowered gas-injection rate (September 1954), this is believed to be the result of the change from "flush" to "settled" production of the producing wells after fracture treatment. Over-all productivity (barrel per psi. drawdown) has changed little during this decline. Even with the lower rate of injection, bottom-hole pressure has remained fairly constant.

The gas-oil ratio has declined in the past year due to reduction in the amount of channeled injection gas being produced. It, therefore, appears that reduced gas-injection rate has enabled satisfactory reservoir performance to continue at a reduction in cost.

Project economics . . . In view of the difficulty of distinguishing between oil recovered by pressure maintenance and by hydraulic fracturing, the economics of the project has been determined by combining them. Source of the low-pressure injection gas is the gas-lift system of nearby Rincon field. Considering the total revenue from the oil less the operating expense and cost of the gas, payout for the fracturing and low-pressure gas sweep has been fairly short.

Tips on Mud Valves for Toolpushers . . .

Allen Woolf closes a MUDWONDER valve on the fill-up line of Woolf & Magee Rig #11

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by Allen Woolf, Toolpusher, Rig #11 • Woolf & Magee Drilling Contractors, Tyler, Texas

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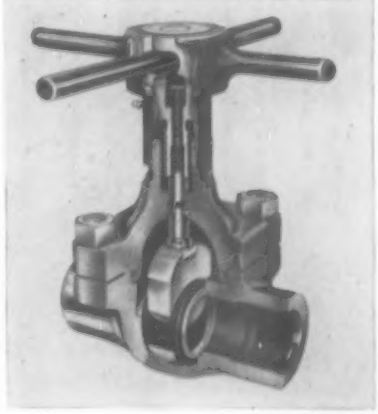

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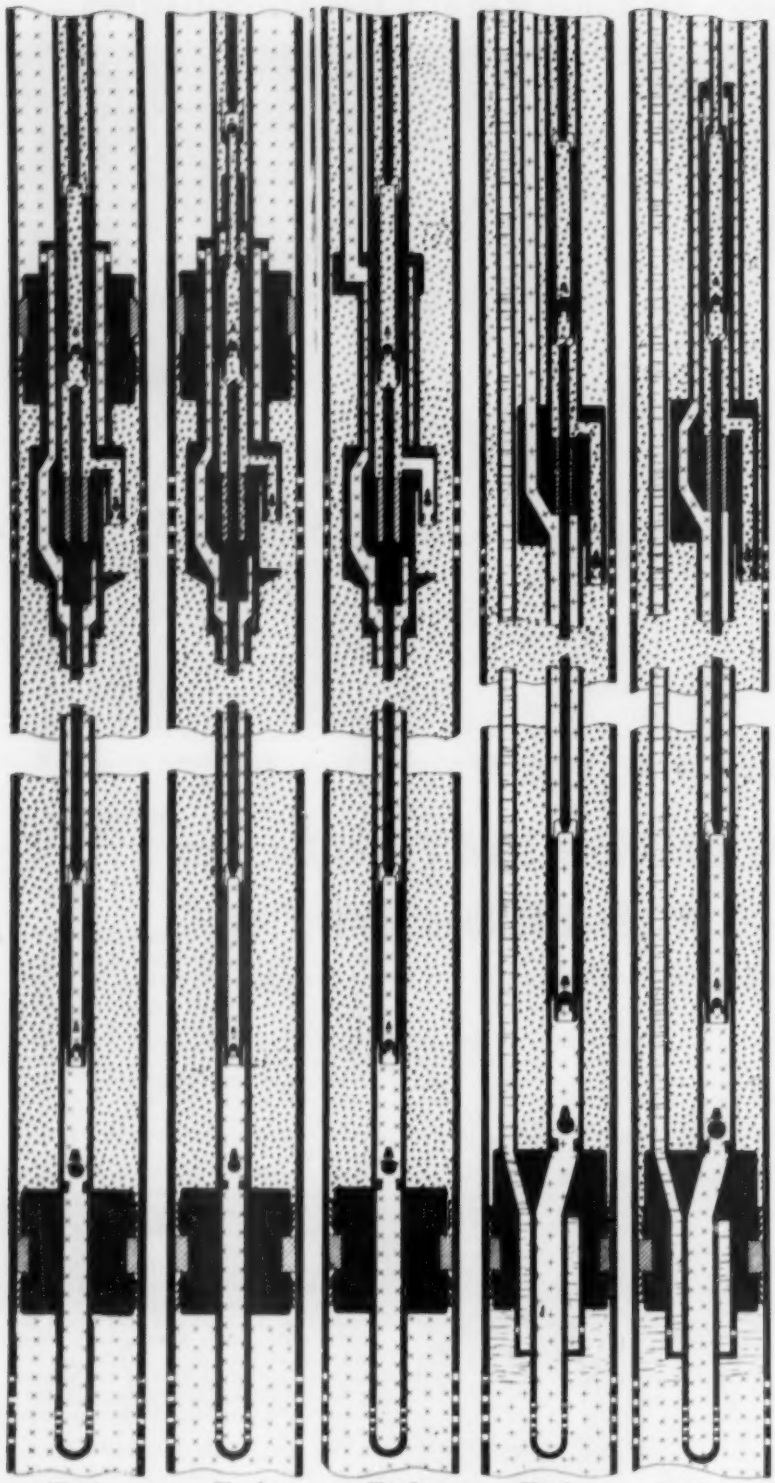

FIVE WAYS to use dual-zone pumps on a single rod string. Single-packer method is most versatile because it allows venting of gas to get top pump efficiency.

What's the Best Way to Dually Produce A Well?

. . . Here's the case for sucker-rod pumping

by Harold Palmour

NEW tools for pumping dually completed wells with sucker rods offer the producer every control in a dual well that is possible in a single well. A single-packer installation is the most versatile method of using these tools. Its advantages are:

- One or both zones may be vented.
- One or both zones may be treated.
- Production from either zone may be controlled by shutting in the gas and reducing pump efficiency.
- One or both zones may be permitted to flow and later put to pumping without tubing being pulled.
- Tubing assembly can be modified to receive separately run parallel tubing.
- Equipment is simple, compact, and relatively low in cost.

All of these features are possible with 2⅜-in.-o.d. E.U.E. tubing run in 5½-in. casing, or 2¾-in.-o.d. tubing run in 7-in. casing.

Choice of method . . . The desirability of one oil well producing oil out of two separate horizons which cannot be commingled is obvious. An abundance of publications have enumerated the rather spectacular savings achieved by the relatively small expenditure of buying and installing dual-zone production equipment as opposed to drilling a second well. However, once a producer has made the decision to dual rather than twin a well, he must then select the method of lift that will be most economical and best serve his operating needs.

His basic selection is between flowing, gas lift, hydraulic pumping, or sucker-rod pumping. Each of these four basic methods has numerous stand-

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ard variations and an almost infinite number of special variations designed to fill the special well requirements or solve a specific well problem. The entire subject of dual zone production is indeed complex, and many oil companies have had engineers assigned primarily to this project for years in order to become thoroughly familiar with its many facets.

In this article, we will deal only with the application of sucker-rod pumps to dual-zone production. We will describe the application, advantages, and limitations of the various standard models of dual-zone pumps, as well as some of the possible variations in the standard models.

Dual rods ideal . . . The first, and probably the simplest method to understand, is the method of setting two pumping units and running two strings of tubing and sucker rods, and two down-well pumps. In this installation, the long string produces the lower zone from beneath a packer, while the short string produces the upper zone from above the packer.

The prime advantage of this system is complete control of production rate from each zone since either unit may be slowed down, speeded up, or shut down at will. A second advantage is that gas may be separated from the upper zone and removed at the casing head. A third advantage is the fact that in areas where paraffin is a problem, hot oil may be added down the casing and returned with the upper-zone production whenever paraffin buildup becomes excessive.

But cost is high . . . Due to the space required by two parallel strings of 2⅜-in. A.P.I. tubing, at least 7-in. casing is required for such an installation, and the tubing couplings must be turned down and tapered liberally at the ends to facilitate running the strings one at a time. The biggest disadvantage of the two-pumping-unit method is high initial-installation cost.

There are also well-servicing problems associated with pulling or running either string because of the proximity of the two stuffing boxes at the well head. But these are mainly matters of procedure, and after proper preparation, either rod string or the short tubing string may be pulled without disturbing the long tubing string.

Single rod costs less . . . Method two—and the one most often used in dual rod-pump installations—is the two-packer method illustrated in Fig. 1. This is, in most cases, the most economical of all of the methods from the standpoint of original equipment cost. So its possible application to any dual installation deserves special consideration.

In a two-packer installation, the lower packer separates the perforated intervals of the lower and upper zones. The upper packer is set above the upper-zone perforations, and permits the annulus between the tubing and casing to be used to conduct the fluid pumped from the lower zone to the surface.

As illustrated schematically in Fig. 1, the upper zone fluid is taken into the pump suction at the crossover shoe and discharged up the tubing string. A pack-off and seal below the upper pump separates the fluids of the two zones, while the polished rod stroking through the packoff actuates the lower rod string and lower pump.

Pumps zones far apart . . . The upper and lower pumps may be located any distance from a few feet apart (in some installations the polished rod of the upper pump serves as the pull rod of the lower pump) to several thousands of feet apart. Initially, the spacing between the pumps must be accurately established so that both pumps may be seated. With competent supervision, this problem is relatively simple. But an indispensable requirement is a variety of pony rods and box and pin subs to provide the exact spacing required within a relatively few inches.

All manufacturers of dual-zone (or two-zone) pumps now offer complete insert pump assemblies that may be re-

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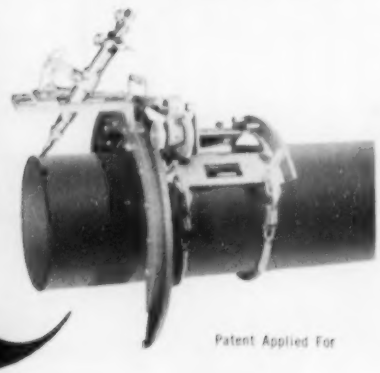

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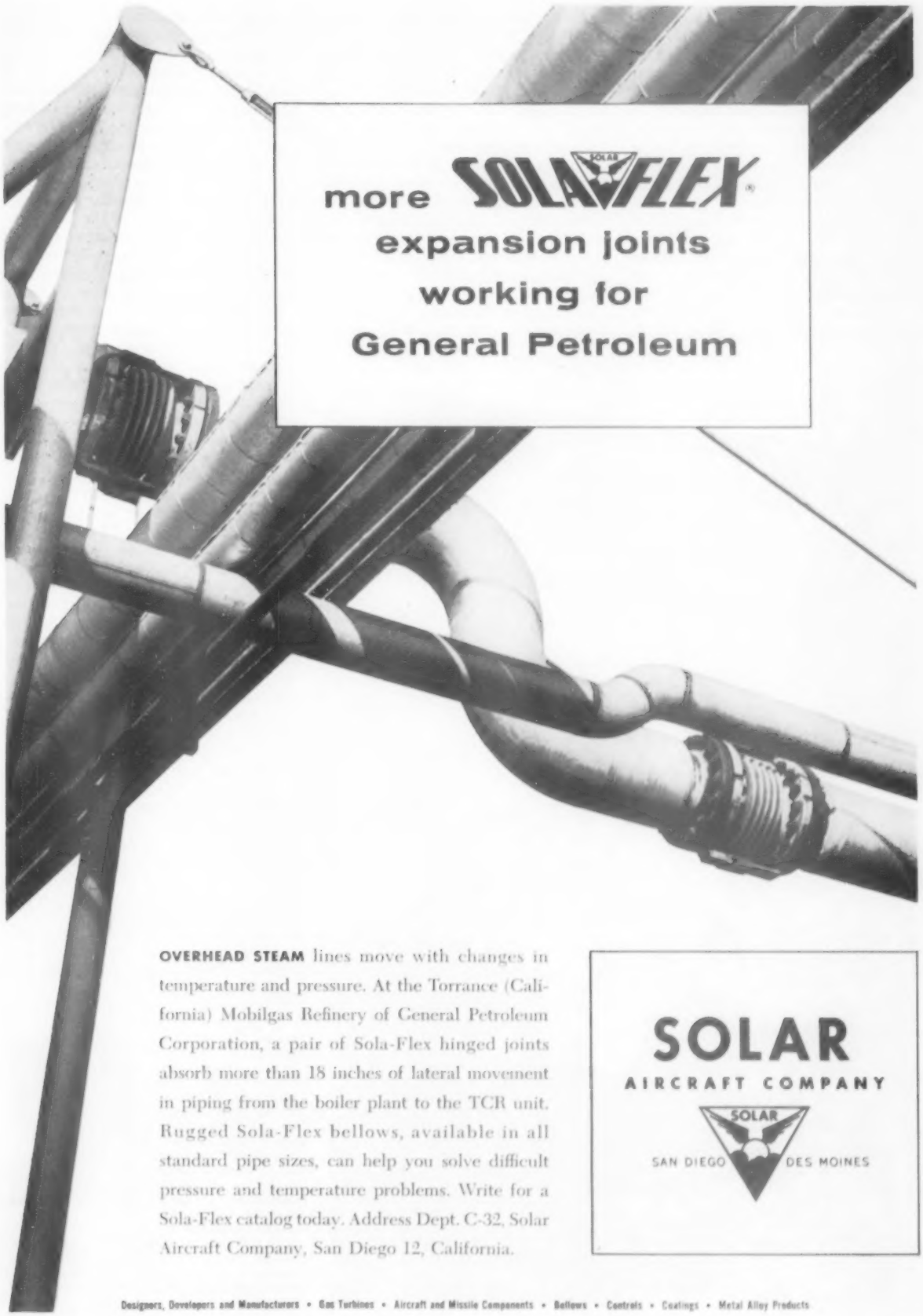

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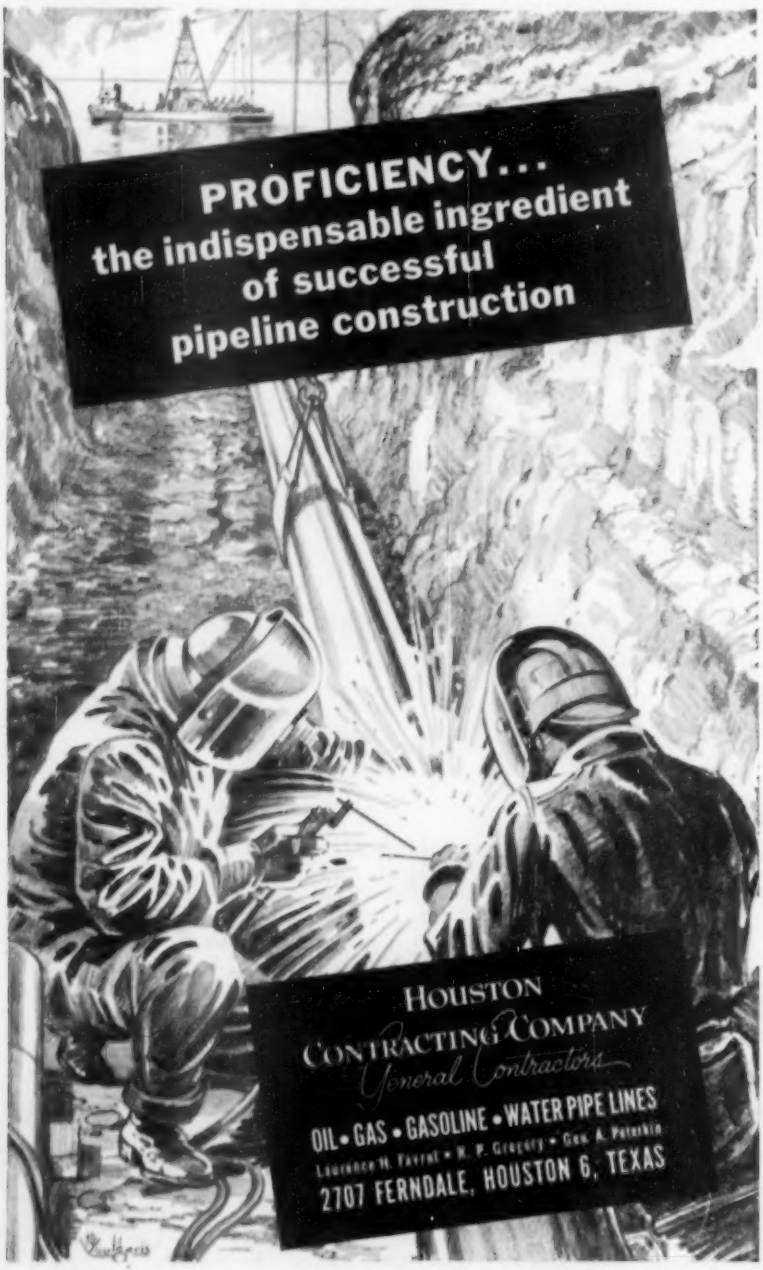
paired or replaced without pulling tubing. Manufacturers differ in their approach to the rather knotty problem of the standing valve for the upper pump. Since the polished rod strokes through the space normally occupied by the standing valve, something other than standard practice must be used.

One manufacturer builds this standing valve in the form of a ring which controls fluid flow through an annular fluid passage surrounding the polished rod. Another runs an ingeniously arranged "traveling standing valve" which uses A.P.I. balls and seats and controls fluid flow through a hollow polished rod. A third manufacturer utilizes standard A.P.I. cages recessed into the crossover shoe. Since it would require a tubing job to pull and replace one of these valves, this manufacturer offers a compound-type upper pump, the upper valve of which takes over as a traveling standing valve if one of the valves in the shoe should fail (see Fig. 2).

Thus all manufacturers of the two-packer style of dual zone pump now have all parts normally subject to periodic replacement arranged so that repairs can be made with a relatively simple rod job.



Two packers not flexible . . . As mentioned earlier, the principal advantage of the two-packer installation is the low initial investment and the fact that no special tools and surface procedures are required in running the single tubing and rod string. The biggest disadvantage is the lack of flexibility. No gas can be separated from either zone, and there is no possibility of treating either zone with hot oil, paraffin solvent, or corrosion inhibitor.

One of the first deviations of the standard two-packer method was the elimination of the top packer. This was done by running a parallel string of tubing to the surface to conduct the lower-zone production to the wellhead, and so leave the casing annulus free for separating gas and for any required treatment of the upper-zone production. This deviation can be accomplished with only minor modification of existing two-packer dual-zone tools—usually by merely adding a parallel string takeoff collar (Fig. 3).

Two other deviations of the two-packer method are also in use. In one, hollow sucker rods conduct the upper-zone production to the surface, while the lower-zone production is produced up the tubing. In the other, a "double crossover" arrangement permits the lower-zone fluid to be produced up the tubing while the upper zone is diverted out to the parallel string. This latter method is useful mainly where bad paraffin deposition from the lower zone makes it desirable to conduct it up the tubing where scraper-equipped rods along with external hot-oil treatments can be used.

Versatile single-packer method . . . The latest development in a rod-actuated dual-zone pump is a tool designed exclusively for use in single-packer installations. This is the most versatile installation of all because: (1) It permits venting gas from both zones; and (2) it can be run in 5½-in. casing. This single-packer model is actually an outgrowth of the parallel-string deviation

THE AUTHOR

Harold Palmour is manager of technical services for Fluid Packed Pump Co. He joined the company in March 1949 and has served in the following: district sales representative, assistant to the division manager, manager of Southwest "A" Division, manager of the special equipment division. He was promoted to his present position in March 1956. Palmour received his bachelor of science degree from North Texas State College in Denton. He now offices in Fort Worth.

of the two-packer model. But because it is designed specifically for single-packer use, it contains some unique features.

A single retainer-type production packer is used with the tubing-sealing assembly constructed in such a way as to have an outlet for the lower-zone gas directly under the packer (Fig. 4). The gas which would tend to collect beneath the packer can escape through perforations into the annulus around the production tube, in the seal nipples, and up the ¾-in. vent line to the surface. The production tube is packed off under the gas perforations, which allows the production inlet to be extended below the packer as far as desired. This provides an opportunity for gravity separation of gas and oil, with an escape for the gas.

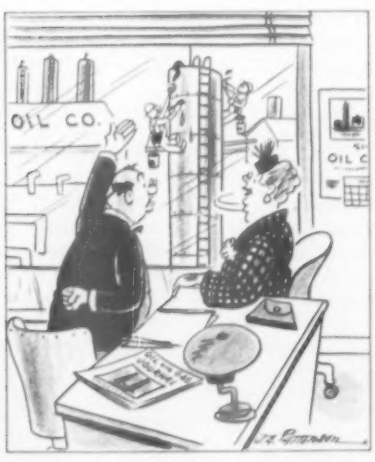
The lower-zone production enters through the perforations in the flow tube below the packer, passes upward in the production tube through the seal nipples, and then enters the lower pump. The lower-pump seating shoe may be directly above the locator sub on the seal nipples. After passing through the lower pump, the lower-zone production continues up the 2⅜-in. tubing to the tubing assembly, where it is transferred to a parallel string of 1-in. pipe and is produced through the 1-in. at the surface.

The upper-zone production enters the upper pump directly through the standing valve on the tubing assembly, then continues up the 2⅜-in. E.U.E. tubing to the surface. The tubing assembly may be located below the upper-zone perforations in the casing, thus giving gravity separation for the upper-zone gas. The upper-zone gas is vented at the wellhead through the casing.

Fig. 5 illustrates a modification of this design where the upper-zone production is brought up through hollow rods and the lower zone up the 2⅜-in. tubing. Since hollow sucker rods are not designed for large volumes of fluid, this design is limited to fairly small production from the upper zone.

Simplicity a factor . . . Experience has proved that in most cases, a ratio-compound or two-stage pump in the lower zone will produce with efficiencies high enough to make the desired production. In this case, the vent line need not be run. This makes possible the simplest installation of all—a single packer, a single string of tubing, and a single string of hollow sucker rods. The running of such an installation can be further simplified by running a single joint of tubing between the crossover shoe and the lower packer, then "prespacing" the rods so that no rig time is required in spacing out between pumps.

The new tools now available for pumping dually completed wells with sucker rods offer the producer every control in a dual well that is possible in a single well. The splendid cooperation between the oil operators, the manufacturers of packers and wellheads, and the pump companies in working together to develop dual pumping equipment has made this rapid progress possible.



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T.P.R.C. REPORT:

How Texas Prorates Gas Production

Railroad Commission is required to prorate each common gas reservoir separately

by John S. Cameron, Jr.

THE rapid growth and development of the gas industry in Texas has been phenomenal in the last 20 years. Total gas produced in Texas jumped from 844,738,000 M.c.f. in 1936 to 5,740,458 M.c.f. in 1955. In 1955 the proved natural-gas recoverable reserves in Texas increased 3.2 trillion cubic feet to 108,278,548 trillion cubic feet, nearly one-half of the total reserves of the United States.

Texas produced 1.04 per cent more gas in 1955 than it did in 1954 from a total of 11,793 producing wells in 1,750 gas fields.

Need for ratable take . . . This great growth and expansion has presented the Texas Railroad Commission with many problems — some similar to previous problems encountered in the early days of oil proration, and some as new and varied as the very character of the components of the natural gas it regulates. The commission is required by statute (Article 6008, Section 1 of the Revised Civil Statutes of Texas) to prorate and regulate gas production in such way that both public and private interests will be protected from waste, correlative rights will be protected, and ratable take be had among all the wells producing from a common reservoir.

The commission, fully aware of its statutory duty, is confident that ways and means will be found to assure ratable take in gas. The ideal goal to aim at is that each producer will have a fair chance to produce his fair share of the gas in a common reservoir thereby preventing waste, protecting correlative rights, and having ratable take.

The commission's approach . . . To get the distinction between oil proration and gas proration, we first need to discuss the oil-proration plan now used by the commission. The plan for oil proration is to limit the total state oil production to a figure found by the commission, after notice and hearing, to be the actual amount needed in the month ahead based upon reasonable market demand. This amount is subsequently divided among the oil fields in accordance with their efficient rates, then each field's allowable is divided among the individual wells in accordance with the allocation formula adopted with the field rules.

By the statutes, the commission is required to prorate each common gas reservoir separately. The market demand from each common reservoir is determined before the twentieth day of each month from nominations filed monthly. Of the 11,793 gas wells now producing, 6,234 are located in prorated fields or fields in which specific field rules and allocation formulas have been adopted. Table 1 shows the number of prorated wells in each Railroad Commission district as of March 1, 1956. All gas fields in Texas operate under Statewide Rule 25 at allowables of 25 per cent of their potentials until specific field rules are adopted. The field rules adopted for fields include rules for spacing, casing program, allocation formula, and the standard balancing rule.

After nominations are received on each reservoir, they are totaled and should represent the total market demand for gas from that reservoir for that particular month. However, to

Author is senior engineer in charge of gas department, Railroad Commission of Texas, Austin.

Summary of Gas Production in Texas, 1936—1955

Year	Number of gas wells produced	Gas-well gas produced M.c.f.	Casing-head gas produced* M.c.f.	Total gas produced M.c.f.	Per cent of gas flared*†
1936	2,717	575,275,000	269,463,000	844,738,000	11.94
1937	2,943	658,713,000	335,175,000	993,888,000	9.19
1938	3,158	705,908,000	393,367,000	1,099,275,000	12.48
1939	3,246	872,286,000	442,773,000	1,315,059,000	10.83
1940	3,403	1,087,089,000	452,238,000	1,539,327,000	8.62
1941	3,553	1,382,830,000	427,462,000	1,810,292,000	5.59
1942	3,685	1,508,794,000	402,328,000	1,911,122,000	4.29
1943	3,800	1,683,920,809	438,647,209	2,122,568,018	4.29
1944	3,962	1,907,704,332	527,013,593	2,434,717,925	4.58
1945	4,658	2,065,266,423	599,911,322	2,665,177,745	4.47
1946	5,122	2,098,867,220	664,545,023	2,763,412,243	3.93
1947	5,438	2,231,430,080	706,070,607	2,937,500,687	3.33
1948	5,750	2,540,917,386	707,303,721	3,248,221,107	3.15
1949	6,493	2,739,790,600	770,732,048	3,510,522,648	1.19
1950	7,310	3,099,606,096	924,570,897	4,024,176,993	0.70
1951	8,296	3,518,486,197	1,155,049,259	4,673,535,456	1.01
1952	9,202	3,779,106,990	1,310,269,791	5,089,376,781	3.62
1953	10,257	3,835,635,847	1,479,135,184	5,314,771,031	5.59
1954	11,224	3,955,492,811	1,555,169,157	5,510,661,968	4.63
1955	11,793	4,061,169,733	1,679,288,713	5,740,458,446	4.71
Total		44,308,289,524	15,240,512,524	59,548,802,048	‡4.93

*Does not include all casing-head gas flared prior to August 1952. Prior to that time casing-head gas not utilized was not required to be reported. †Per cent of total gas produced and reported as vented or flared. ‡Average per cent of gas flared.

Note: Gas volumes in thousands of cubic feet (M.c.f.) at 14.65 psia. and 60° F.

TABLE 1 — PRORATED WELLS AS OF MARCH 1, 1956*

District 1	27
District 2	317
District 3	373
District 4	529
District 5	39
District 6	486
District 7-B	14
District 7-C	47
District 8	33
District 9	86
District 10	16
Total	1,967
†Bethany field (Dist. 6)	197
†Carthage field (Dist. 6)	700
†Hugoton field (Dist. 6)	870
†West Panhandle field (Dist. 10)	2,500
Grand total	6,234

*Nonassociated gas schedule issued monthly from gas department, Austin office, Railroad Commission of Texas. †Nonassociated gas schedule issued monthly separately from regular schedule. The schedules for these fields are being prepared on I.B.M. equipment by the gas department, Austin office, Railroad Commission of Texas.

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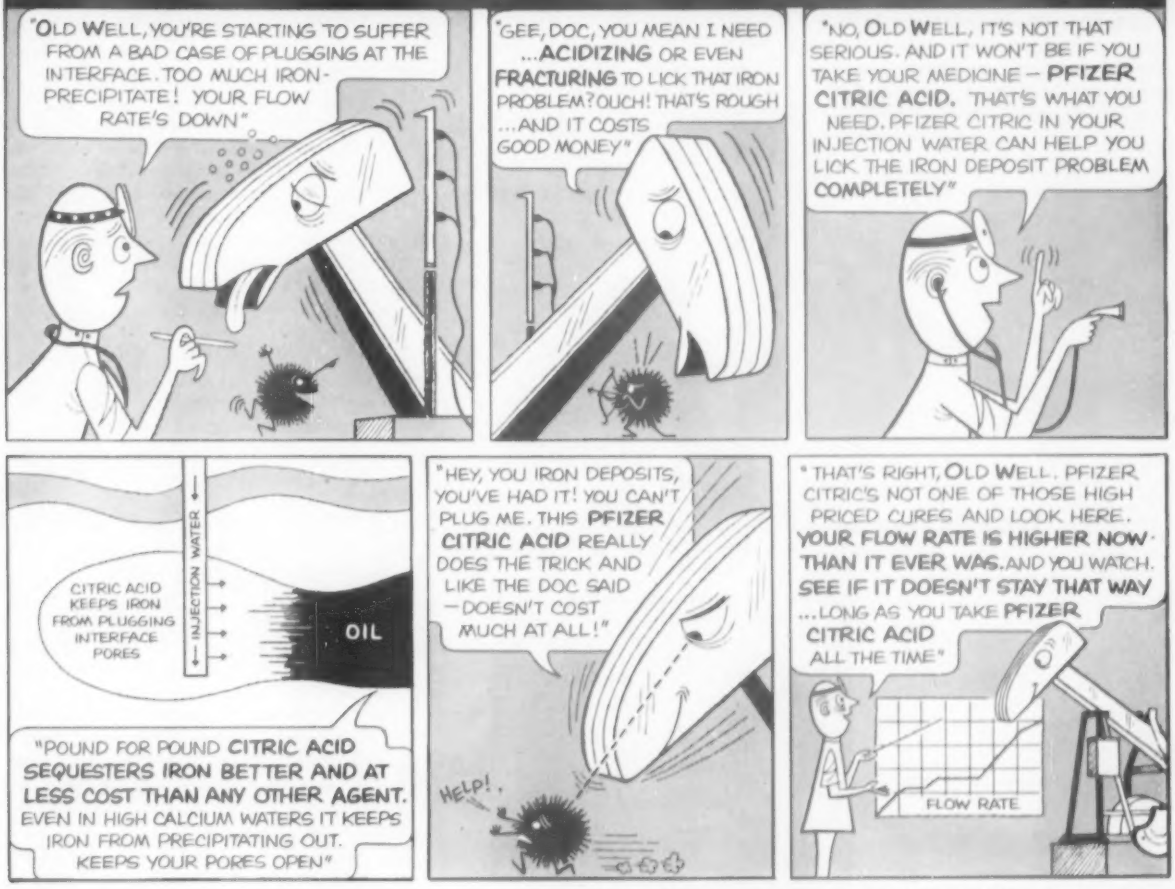
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"GEE, DOC, YOU MEAN I NEED ...ACIDIZING OR EVEN FRACTURING TO LICK THAT IRON PROBLEM? OUCH! THAT'S ROUGH ...AND IT COSTS GOOD MONEY"
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determine the reasonable and required market from that field, the nominations must be adjusted to actual production to maintain the field in balance. This is done by applying the difference between a month's actual production and nominations to the current month's nomination. The current month's nominations are corrected by the amount that the third previous month's nominations were over or under produced.

For example: With the production reports and nominations for January 1956, on hand, we calculate the April 1956 total reservoir allowable.

Total nominations for January	100
Total allowable (including supplements) to nonprorated (incapable wells) for January	10
Total nominations in January for capable wells	90
Total production in January	80
Difference in January	10
Total nominations for April	100
Minus January difference	10
Total April reservoir allowable for all wells	90

The total reservoir can be adjusted by any amount by the commission when, in its judgment, adjustments should be made to obtain ratable take. The total reservoir allowable is then distributed among the wells according to the allocation formula adopted for that reservoir.

In assigning each well an allowable, we further require semiannual capability tests to show the productive capacity of each well as it produces into its pipeline. With these tests, we do not assign more allowables than a well is capable of producing. The allocation formula is applied to a field and the incapable wells are assigned allowables at their capacity and then the allowable assigned these nonprorated wells is subtracted from the total reservoir allowable and the remaining allowable is assigned to the capable or prorated wells. Thus, prorated wells are wells allowables of which are determined by the allocation formula and nonprorated wells are wells allowable of which under the allocation formula would be greater than their capability so they are limited to their ability to produce as shown on our Form GWT-2.

It should be noted that various allocation formulas are in effect in these prorated fields but the most widely adjusted formula is two-thirds acreage plus one-third per well. Probably the most important factor in any formula is acreage. The commission has been very reluctant in recent years to adopt an allocation formula involving potential since that factor is subject to considerable abuse and is considered by many engineers as being at best inaccurate and questionable.

Balancing periods to adjust the overproduction and underproduction in a prorated gas reservoir were adopted by the fiftieth session of the Texas Legislature as Senate Bill 431 in May 1947, and were first applied in Carthage field, Panola County, Texas, in September 1947. They were subsequently adopted with the field rules adopted for other fields. Then on March 23, 1953, the commission adopted the requirements of Senate Bill 431 as Statewide Rule 24 (b). Prior to the adoption of the balancing periods, underproduction was lost if not produced and underproduction had to be made up immediately as oil wells are presently prorated. The periods between 7:00 a.m. March 1 and ending 7:00 a.m. September 1 and between 7:00 a.m. September 1 and ending 7:00 a.m. March 1 have been specified as balancing periods. Therefore, the commission's gas department determines the status or balance of every nonassociated gas reservoir on March 1 and September 1.

The overproduction and underproduction of all the wells are totaled to

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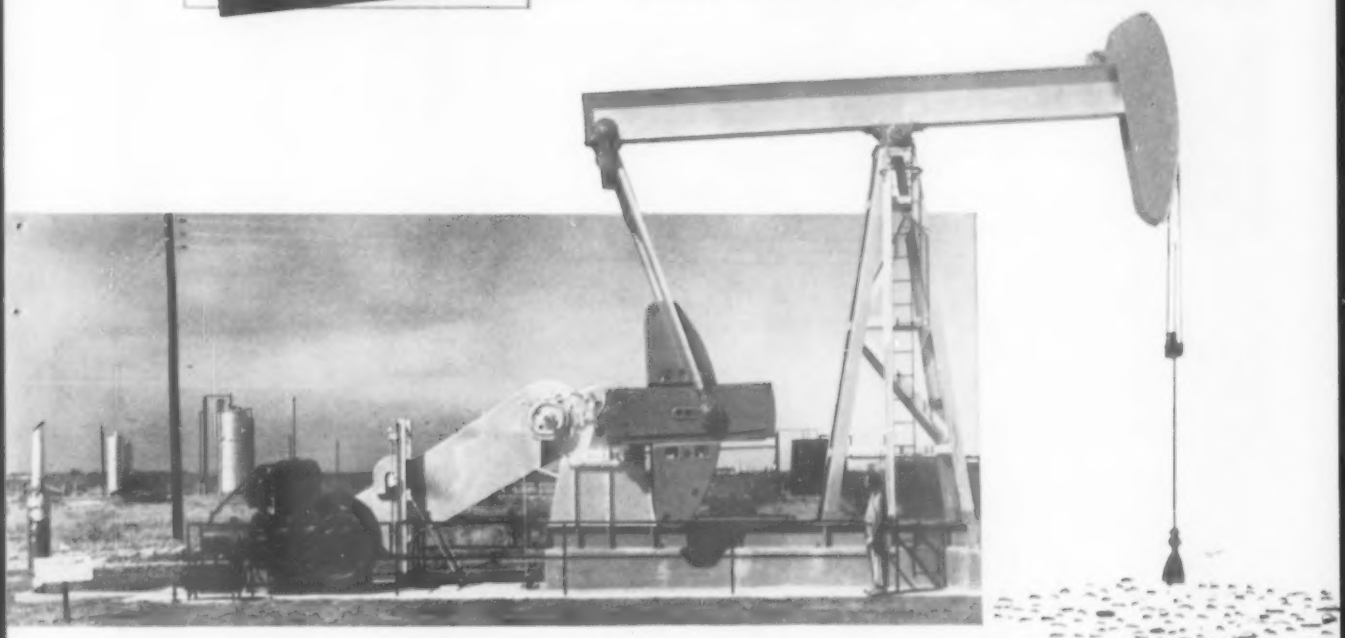

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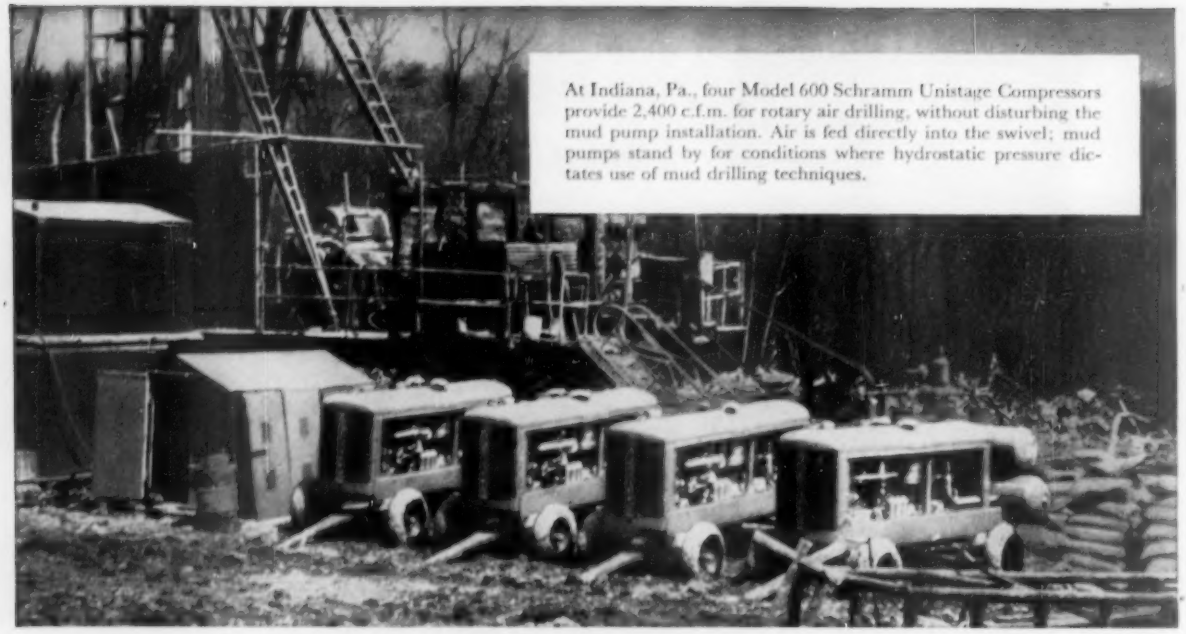

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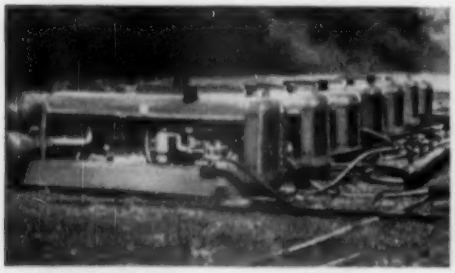

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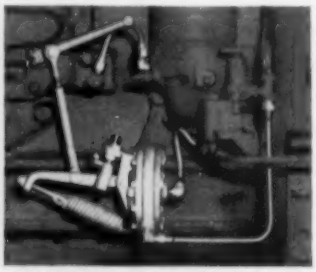

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get a field status or balance. The May and November schedules are adjusted by the amount that each field is out of balance. If a field's status is found to be overproduced on March 1, the May total reservoir allowable is increased by the amount of that overproduction to balance the field. Likewise, underproduction is subtracted.

The balancing rule specifically requires: (1) underproduction accumulated in one period must be made up by the end of the following period or be canceled, (2) overproduction accumulated during one period must be made up in the following period by underproduction or the well must be shut in until all the overage accumulated as of the second period is absorbed by underproduction, (3) underproduction cannot be made up at a rate in excess of twice the normal monthly allowable or at a rate in excess of 25 per cent of the daily open-flow capacity of the well, and (4) a producing well underproduced through two successive balancing dates shall not be assigned an allowable greater than the maximum monthly production had from that well during the last balancing period.

The commission has never issued allowables on the basis of the reserves under a well. When a pipeline is contractually committed to produce according to reserves we frequently find that production to be considerably different from the allowable assigned by the present system.

In the year just past, the commission adopted several new methods, whereby, we do hope to have more ratable take in the fields so affected. First, in Henze field, De Witt County, Texas, the commission ordered that each well's participation factor or per cent of the field be calculated and that each well's allowable would be its participation factor times the total actual production had from that reservoir. Therefore, the allowable is always equal to the actual production for any month in Henze field. Incapable wells are given actual production as allowable and no well can get more than 300 per cent of its average allowable overproduced.

In Waskom field, Harrison County, Texas, the commission adopted the same type rules as the Alco-Mag rules. In Waskom we have the problem of steady markets and seasonal markets whereby some producers have a firm year-round demand and others have a peak demand in winter. We are determining the market demand by considering current nominations along with actual production history. We do not have the problem of unconnected wells in Waskom field, so our rule there should result in ratable allowables and afford each producer his fair share.

Texas' present method can provide ratable take if all the operators and pipelines will let it. Panhandle field is a good example in that the nominations are very accurate and very little underproduction is canceled. There is no question but that voluntary interconnection of pipelines in any gas field goes a long way toward solving most of the gas proration. The commission has not ordered pipeline interconnection state wide in the past

State-wide gas proration does not seem feasible now because of the widespread distances between fields and differing reservoir conditions in various portions of the state. With the continued expansion of the pipeline systems in the state some feasible plan may be worked out in the future when the demand for gas levels off. Perhaps a plan whereby we can prorate various areas of the state, such as the Panhandle, East Texas, Gulf Coast, etc., can be worked out when sufficient pipelines are available to all at approximately the same conditions. State-wide gas proration is certainly the ideal system to work for.

References

1. The Oil and Gas Journal, March 19, 1956, pp. 122-123.
2. From annual reports of the Railroad Commission, 1936-1955.

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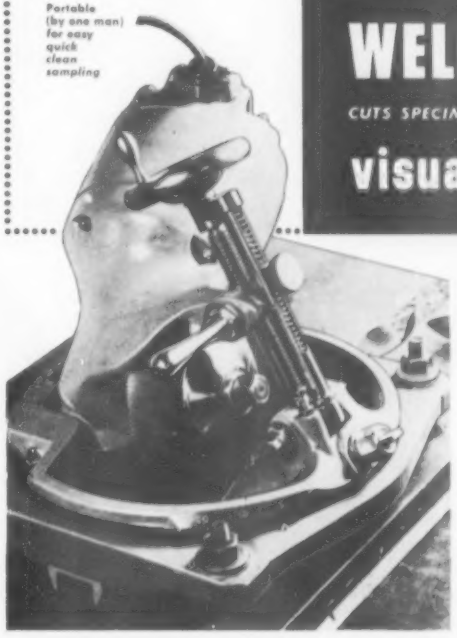

Longitudinal, transverse and oblique (a, b & c) specimens removed by Weld-Prober. Below are drawings of tension and bend test (d & e) specimens that may be machined from them.

The Weld-Prober cuts out specimens from butt welded joints so that the quality and soundness of the weld may be examined. Such specimens reveal the workmanship of the weld by exposing defects, if any, such as slag inclusions, lack of fusion, cracks or porosities. Physical and mechanical properties of the joint can also be determined by machining the specimens into tensile, bending, impact or other form of test piece.

Of particular advantage is the favorable shape of the cavity produced by the Weld-Prober. This opening can be quickly and easily re-welded without further preparation and without a backing plate.

The Weld-Prober is basically a spherical saw driven by an electric motor through reduction gearing. Mounting is such that opposing positioning produces the specimen shown . . . up to 1⅛" deep.

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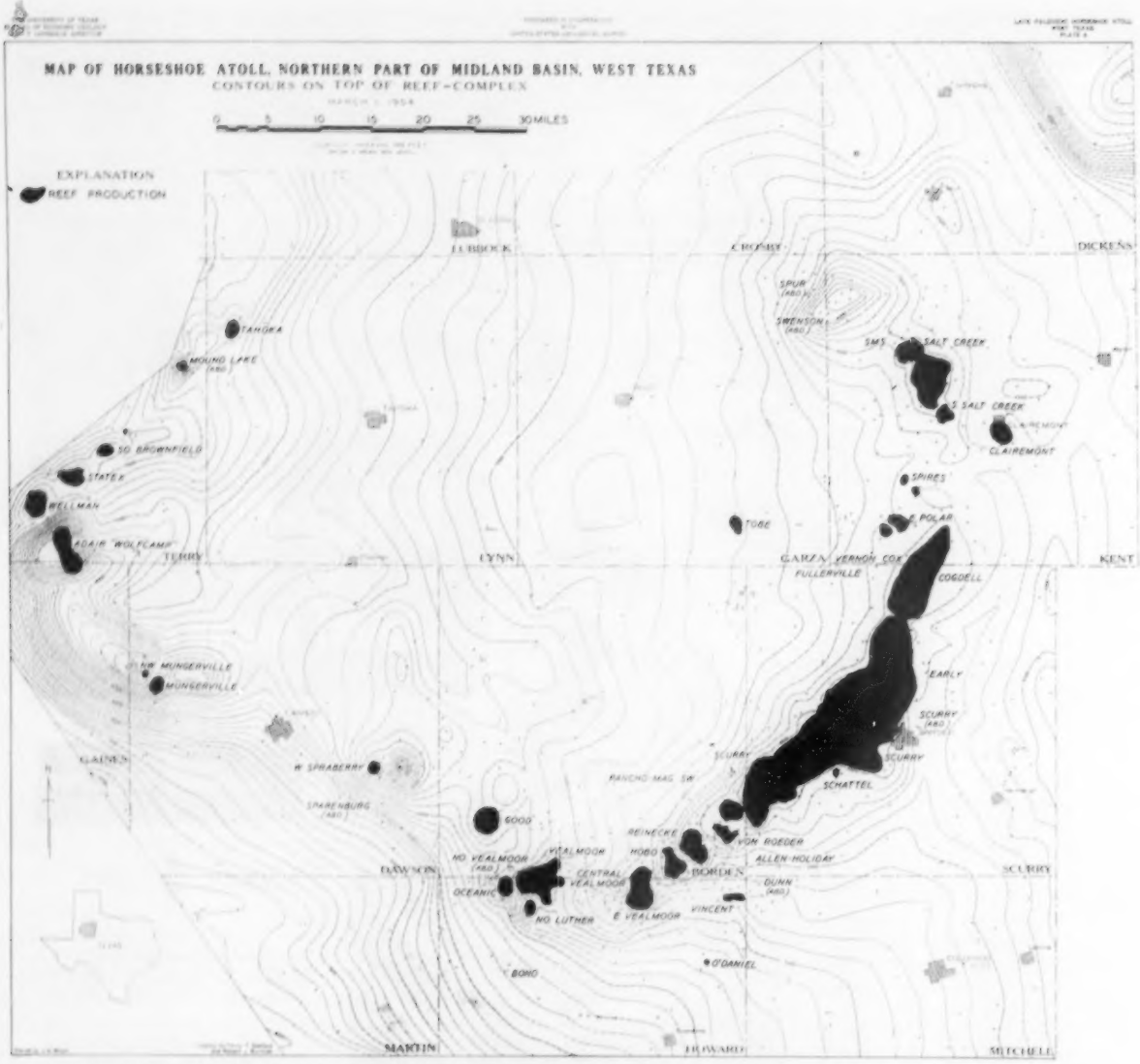

THE HORSESHOE ATOLL is an arcuate reef with production concentrated on the local closures and high spots. Fig. 1.

Geological Summary of the Late Paleozoic

Horseshoe Atoll in West Texas

Oil fields on this atoll have produced over 250 million barrels of oil. Here's a summary of the geology and reservoir characteristics of this important trend

by Donald A. Myers, Philip T. Stafford, and Robert J. Burnside

OIL was first produced on West Texas' Horseshoe atoll from reef rocks in 1938; however, discoveries of large reservoirs were not made until 1948 when the part of the atoll underlying Scurry County was drilled. From January 1, 1939, to January 1, 1956, oil production from the Horseshoe atoll exceeds a quarter of a billion barrels. Production in the atoll is from reef rocks of Strawn, Canyon, Cisco, and Wolfcamp ages. The bituminous shales of Wolfcamp age surrounding the atoll are suspected to be the source of the oil.

Authors are geologists with the Geological Survey, U. S. Department of the Interior.

The oil reservoirs and fields of the atoll are interconnected by the stratigraphically lower, more porous parts of the reef. They are also connected with the structurally high water-saturated parts of the reef. Because of the porosity zonation, a natural water drive will be effective only in those zones which have good porosity and permeability and which lie in direct contact

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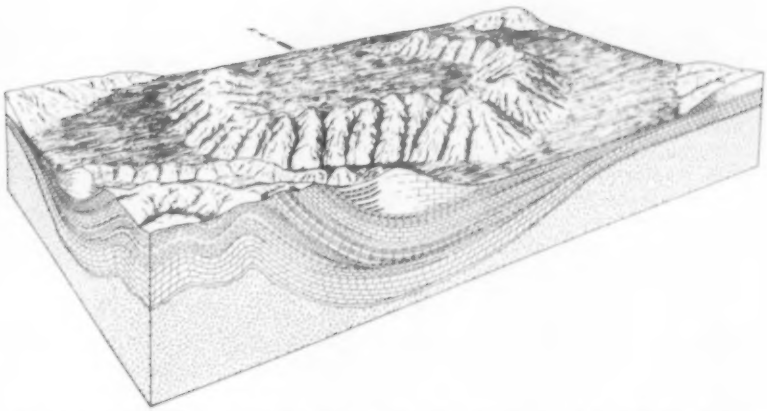


RECONSTRUCTION of the northern part of the Midland basin in late Pennsylvanian time vertically exaggerated to emphasize the configuration of the Horseshoe atoll. Fig. 2.

TEXAS-LOUISIANA
NEW ENGINEERING TECHNOLOGY

with the oil-water interface. It is believed that the technique developed in correlating zones of different porosity will aid in the understanding of the porosity relationships in the atoll and in secondary-recovery efforts.

Regional geology . . . The Horseshoe atoll is a subsurface accumulation of fossiliferous limestone which is as much as 3,000 ft. thick and which was deposited during Pennsylvanian and early Permian time in the northern part of the Midland basin, in western Texas. It is a horseshoe-shaped mass about 90 miles across in an east-west direction and about 70 miles from north to south. The crest of the atoll is a series of irregular hills and depressions, and the flanks slope gently away to merge with a broad limestone platform on which the atoll rests. Large quantities of petroleum have been produced from reservoirs in the eastern and southern parts of the atoll.

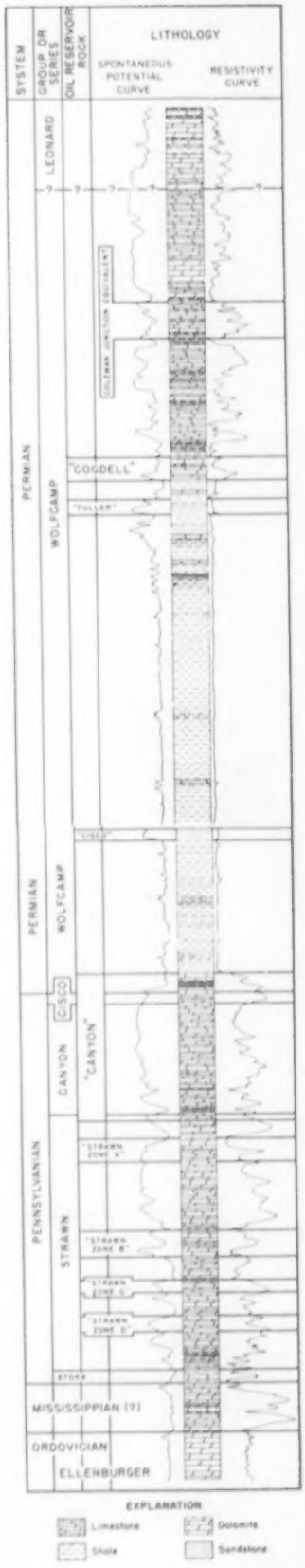
The Midland basin is an asymmetric, subsurface structural and sedimentary basin, bounded by the Matador arch on the north, the Central Basin platform on the west, and the Ozona "high" on the south. The sedimentary rocks in the Midland basin belong to the Quarternary, Tertiary, Cretaceous, Triassic, and Permian through Cambrian systems. The thickest and most complete sequence of sedimentary rock is found on the western side of the basin. In most of the Midland basin, rocks belonging to the Pennsylvanian system consist of a thin sequence of nonfossiliferous shale and siltstone, but in the Horseshoe atoll the Pennsylvanian rocks are many times as thick and include very little noncarbonate or nonfossiliferous material.

Characteristics of the reef rocks . . . The limestone in the Horseshoe atoll is composed of nonbedded clastic calcium carbonate debris of organic origin. It is bonded by lithified lime mud and by calcite cement. The only lithologically distinct units that are traceable from well to well in the atoll are thin beds of dark bituminous shale.

Porosity in the reef rocks is almost entirely secondary. Effective porosity ranges from almost nothing to 30 per cent. Studies of cores and well logs have shown that the atoll contains zones of relatively high porosity (more than 4.5 per cent) having considerable argillaceous material. Chemical analyses indicate that the limestone generally contains more than 97 per cent calcium carbonate. Insoluble residues average about 1.4 per cent of the total limestone by weight.

Stratigraphy . . . The rocks that form the Horseshoe atoll have been assigned to the Strawn, Canyon, and Cisco groups of the Pennsylvanian system and to the Wolfcamp series of the Permian system. Rocks of Strawn age in the atoll have a maximum thickness of 750 ft. They are generally overlain by rocks of Canyon age, but in many places they are overlain by rocks of Cisco or Wolfcamp age. Reef rocks of Canyon age have a maximum thickness of 800 ft. and are generally overlain by rocks of Cisco age, although in some places they are overlain directly by rocks of Wolfcamp age. Reef rocks of Cisco age have a maximum thickness of 600 ft. and those of Wolfcamp age have a maximum thickness of 1,000 ft.

As a result of reworking of the reef rocks at several times during the



COMPOSITE electrical and lithologic log from Scurry and Kent counties, Texas, showing stratigraphic units and oil reservoirs. Fig. 3.

growth of the atoll, the rocks of the different ages are distributed irregularly and discontinuously. Thus reef limestone of Wolfcamp age is found in places high on the crest of the atoll; in places low on the flanks of the atoll; and in places extending tonguelike into shale of Wolfcamp age surrounding the atoll. Studies of the fusulinid faunas in the atoll as related to the porosity zones indicate that these porosity zones may have time-stratigraphical significance. Thin beds of shale appear to mark unconformities in the atoll.

The Horseshoe atoll is underlain by bedded limestone and shale of Strawn and Atoka ages. Throughout most of the area of the atoll these rocks rest on limestone of probable Mississippian age, but in eastern Mitchell County they rest directly on the Ellenburger.

Rocks overlying the atoll are of Wolfcamp age and consist of gray to black shale, siltstone, sandstone, and small amounts of limestone. The terrigenous rocks immediately overlying the atoll apper to have been deposited as a southwestward-transgressing delta, which progressively smothered the atoll and ended its growth.

Paleontology . . . A study of faunal associations indicates that crinoids and fusulinids are the most abundant fossils in the reef rock. Brachiopods, bryozoans, corals, and mollusks are less abundant. Algae are believed to have been present, although little positive evidence of algae has been observed in the atoll.

The reef limestones of the atoll lie almost wholly within the zones of Fusulina, Triticites, and Pseudoschwagerina. Stratigraphic differentiation within the zone of Triticites was based on evolutionary development within the genus, as well as on first appearance of other genera.

Evidence of reworking was found in the Horseshoe atoll. Mixed fusulinid faunas were noted in many calcirudities. The fossils contained in the reef rock indicate that the atoll probably accumulated in tropical marine waters of normal salinity.

Subsurface structure . . . Complex stratigraphic relationships caused by reef and reeflike carbonate masses and abrupt facies changes in the rocks of Pennsylvanian and Permian ages tend to obscure the effects of tectonic movements in the area of the atoll, except for the major regional structures. Contours drawn on rocks younger than the Horseshoe atoll reveal a regional dip to the west and southwest ranging from about 20 to 200 ft. per mile. Two major regional structural features, however, are present in the lower Pennsylvanian rocks on which the atoll rests—a syncline curving around the western and southern sides of the atoll and a regional nose plunging to the southwest in the lagoonal area.

Origin of the atoll . . . Studies of the lithology, porosity, and fusulinid faunas suggest that several periods of erosion took place during the development of the Horseshoe atoll, alternating with periods of growth. It is believed that the alternation between growth and erosion is related to changes in sea level. The Midland basin was subsiding, probably with little interruption, during this time. Low slopes on the flanks of the atoll are mainly a result of reworking of the reef rock —particularly during periods when the sea level was low—and lateral spreading of the resulting detritus.

The shape of the atoll may be explained by the action of winds and currents. Simultaneous deposition of carbonate material in the atoll and noncarbonate material in immediately adjacent parts of the Midland basin indicates abrupt and important differences in characteristics of the water and currents in different parts of the basin.

A new book detailing the Horseshoe atoll by the authors is available from the Bureau of Economic Geology, University of Texas, Austin, at $2.00.

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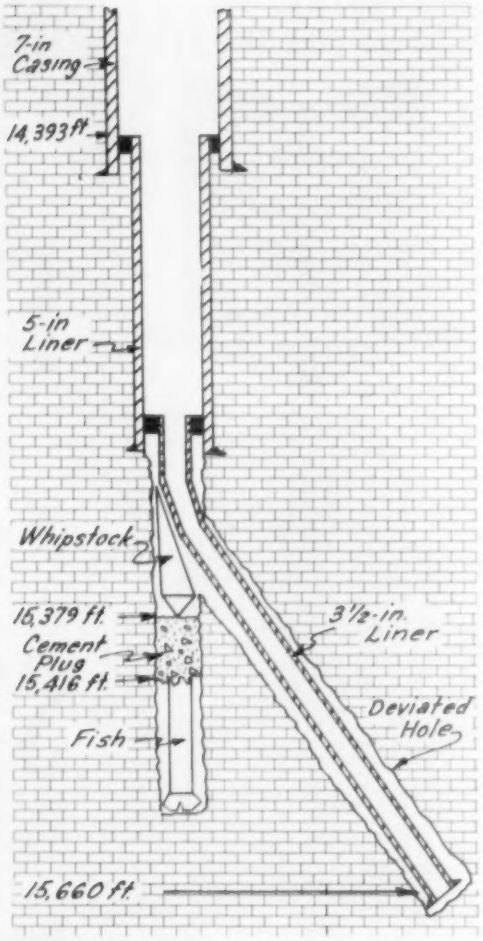
SPECIAL SLIM-HOLE TOOLS used in the sidetracking operation are 3¼-in. whipstock (being held), 3⅛-in. bit with 4⅛-in. hole opener, and the deflecting tool or knuckle joint (on floor). Note relative size to the standard whipstocks in the rack.



SIDETRACKED HOLE was necessary to bypass stuck drill collars and bit in order to get to a lower pay sand. Because operations were through a 5-in. liner, a 4⅛-in. hole was maximum.

Shell Sidetracks Hole Below 15,000 Ft.

Here is the record of one of the deepest "slim-hole" sidetrack jobs ever attempted. A 4⅛-in. hole was deflected around a fish at 15,416 ft. The job was completely successful and this story tells how it was done.

by Ed McGhee
District Editor

RECENTLY, Shell Oil Co. was deepening one of its wells at Weeks Island, Iberia Parish, Louisiana. To do this, a 4⅛-in.-diameter hole had to be drilled below a 5-in. liner which extended to 15,341 ft. If deeper production were found, the plan was to set a 3½-in. flush-joint liner below the 5-in.

The drill string carried 4-in. drill pipe with 3½-in. tool joints inside of the 7-in. casing string down to the top of the liner at 14,393 ft. Inside of the 5-in. liner and below it the drill pipe was 2⅞-in. with 2⅜-in. A.P.I. internal-flush tool joints. There were two 3½-in. drill collars above the 4⅛-in. diamond bit.

While drilling ahead, the string parted on top of the 3½-in. collars, leaving them and the diamond bit in the hole. The top of the fish (drill collars and bit) was at 15,416 ft. Due to the size of the drill collars in the small hole, Shell could not wash over them. A tapered tap was run but broke off in the fish. That ended any further chance to fish the collars out. The only other course, sidetracking the hole, looked questionable in such a small hole at such a great depth.

However, Shell's division office in Franklin, La., conferred with Houston Oil Field Material Co. about undertaking a sidetrack job. It was decided

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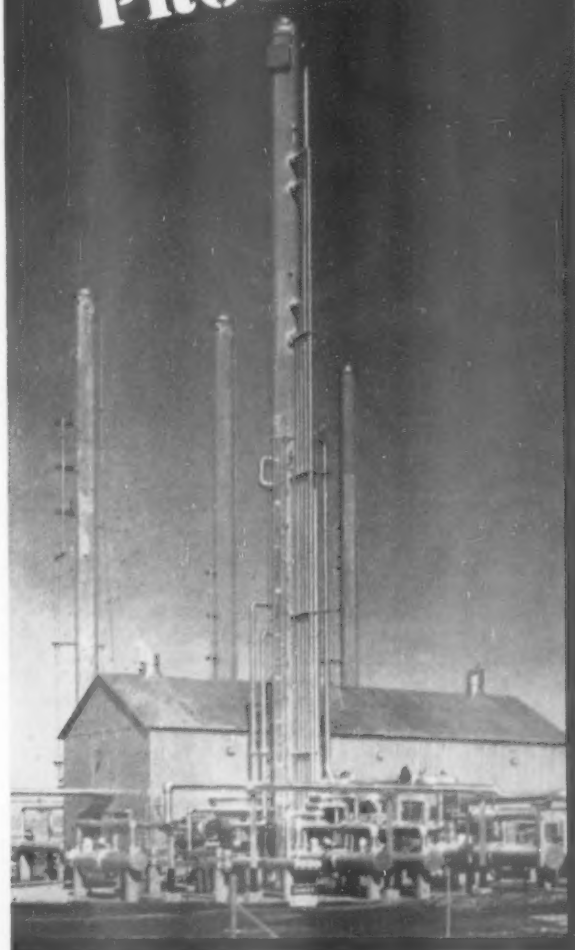

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that an attempt should be made before abandoning the chance for completing the well in the deep sands.

There are no standard deflecting tools for a 4⅛-in. hole. For this reason special "custom-made" deflecting tools had to be designed and made. The small internal diameter of the 2⅞-in. slim-hole drill pipe would prevent using directional-survey instruments necessary to orient the deflecting assembly in a definite direction. In other words, it would be a "blind" sidetrack job since the primary objective would be simply to get by the fish in any direction.

These alternate plans were offered for sidetracking the hole:

Plan 1 . . . The first solution would be deflecting with a conventional whipstock, and a 3¾-in. o.d. whipstock was designed and built. For expediency in manufacture, a 4¾-in. o.d. (which is standard size) was cut in two. The lower half of it, containing the deflecting face, was machined to 3¾-in. o.d. A 3¾-in. o.d. collar for the bit and bit sub was made from solid heat-treatable alloy steel, and welded to the lower half. The new whipstock was then heat-treated and magnafluxed to insure that the welded connection was as strong as the parent metal.

A 3⅛-in. o.d. HOMCO clustered carbide bit was designed and manufactured to drill off the face of the whipstock. Also, a special shear-pin sub was made to pin the whipstock to the drill assembly.

The hole-opening assembly consisted of a specially designed 4⅛-in. o.d. clustered hole opener with a pilot for finding the rat hole.

A stabilizer was made by welding three ribs on a 24-in. long 3½-in. o.d. sub. The outside diameter over the ribs was 4⅛ in.

The plan for this assembly was to make a conventional run and drill a 3⅛-in.-diameter rat hole off the face of the whipstock. The next operation would be to open the 3⅛-in. rat hole to 4⅛ in. with the specially designed hole opener. Following this, a full-gage drilling bit, stabilizer, and short drill-collar assembly would be run.

Plan 2 . . . The second alternative was deflecting with a full-gage assembly. A specially designed 3⅛-in. o.d. clustered carbide pilot bit with an 18-in. long pilot would be run below a 4⅛-in. o.d. clustered carbide hole opener. To get the desired deflection, a 3⅝-in. o.d. slim-joint deflecting tool would be run directly above the pilot bit and hole-opening assembly. The slim-joint deflecting tool is fundamentally a universal-type knuckle joint with a possible 5° angle.

The plan for this assembly was to drill a full-gage hole, thereby eliminating one trip of the drill string. Plan one requires two trips with the drill string.

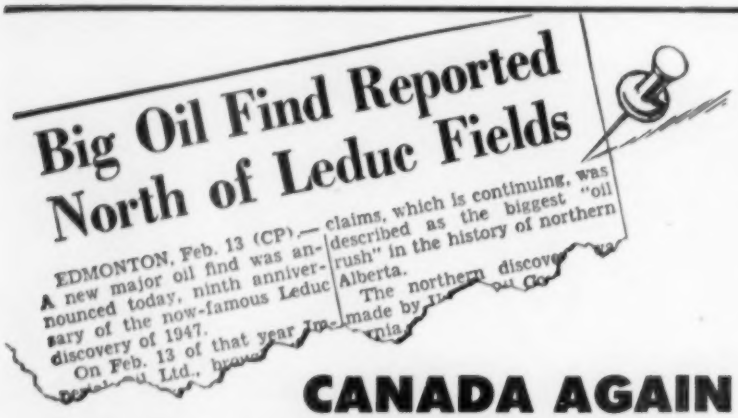
Shell chose to use the latter plan described above. This is how the sidetrack job was then done:

1. A cement plug was set on top of the fish.

2. The plug was tested with a 4⅛-in. o.d. Hughes OW bit and was then dressed off to a depth of 15,379 ft., 37 ft. above the top of the fish. With the plug dressed off and its firmness established, the hole was conditioned for several hours prior to coming out to pick up the full-gage deflecting assembly.

3. The deflecting assembly, consisting of the 3⅛-in. o.d. pilot bit, the 4⅛-in. o.d. hole opener, and the 5⅝-in. o.d. slim-joint deflecting tool, was then run to the bottom for the sidetrack job.

4. With the deflecting assembly on top of the cement job, the operation was begun with 6,000 lb. weight and a rotary speed of 45 r.p.m. Pump pressure was 700 psi. The deflecting assembly drilled from 15,379 to 15,387 ft. It was then decided to come out of the hole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and pick up a 4⅛-in. o.d. drilling bit and stabilizer.

5. Drilling was continued from 15,387 to 15,420 ft. with a 4⅛-in. o.d. bit, 4⅛-in. stabilizer, and two crossover subs. Weight on the drilling assembly was 8,000 lb. Rotary speed was 45 r.p.m. and pump pressure was 700 psi.

6. The formation from point of sidetrack to total depth at 15,660 ft. was a very sandy shale. At a point where 41 ft. of saturated hole had been made, two 15-ft. 2⅞-in. o.d. drill collars and two crossover subs were added to the drilling assembly. This increased its total length to 40.89 ft. Drilling progressed with this assembly from 15,420 to 15,441 ft. Weight on the drilling string was 6,000 lb., rotary speed was 50 r.p.m., and pump pressure was 1,200 psi.

7. Upon reaching 15,441 ft., this assembly was brought out of the hole. The stabilizer and 2⅞-in. drill collars were replaced with two 3½-in. o.d. collars. This assembly successfully completed the sidetracking operation to total depth at 15,660 ft.

The entire operation from the time of dressing off the cement plug until the directional-drilling engineer was released consumed only 4 days.

Shell then made up a 3½-in. liner and ran it into the hole. It entered the open-hole section, passed through the sidetracked point, and reached total depth with no difficulty. The liner was hung from 15,132 ft. in the 5-in. pipe to total depth of 15,660 ft. The well was then completed as a producer from inside the 3½-in. liner.

Special credit is due Gordon Harrigan, HOMCO, New Orleans, for providing technical information on the equipment and sidetracking operation.

"Quit your stallin'—You know what shoes I mean!"

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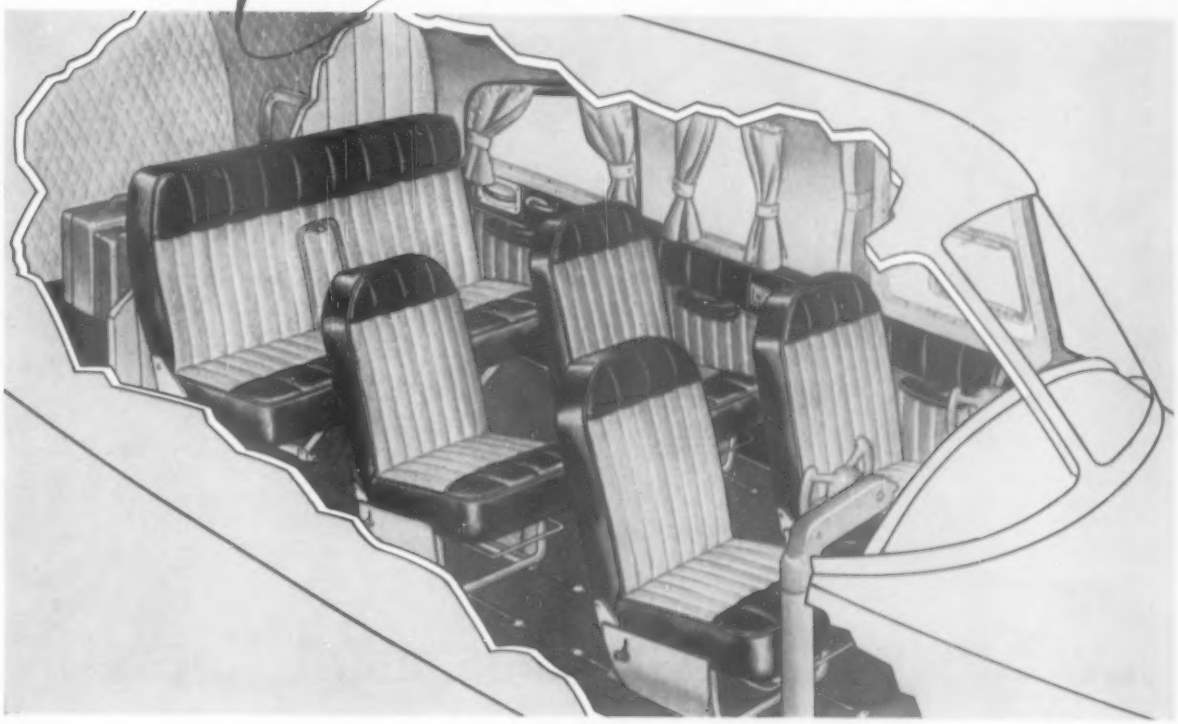

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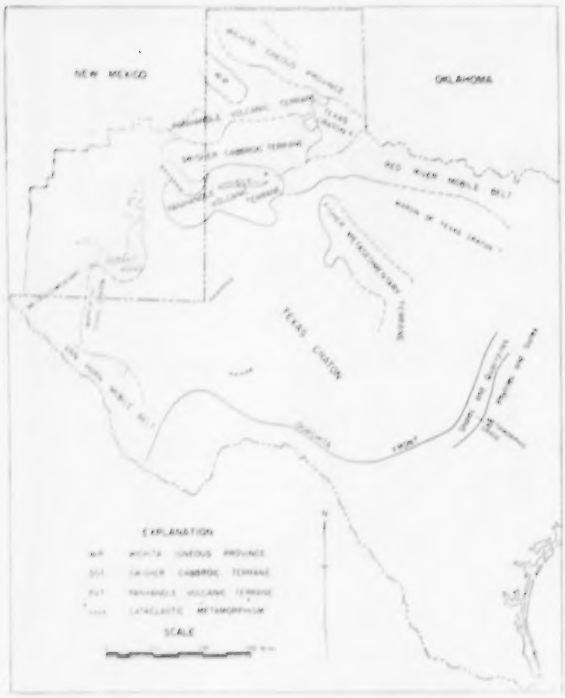


Fig. 1—Principal element of the Texas basement is the Texas craton, a stable positive element that existed in pre-Cambrian time.

Fig. 2—Some of the present-day regional structural features are related to the basement configuration. Compare with Fig. 1.

From University of Texas:

New Study of Texas' Basement Rocks

Basement structure often furnishes a key to the location of new oil fields. Here is a study of the basement rocks of the nation's largest oil-producing region.

by Peter T. Flawn*

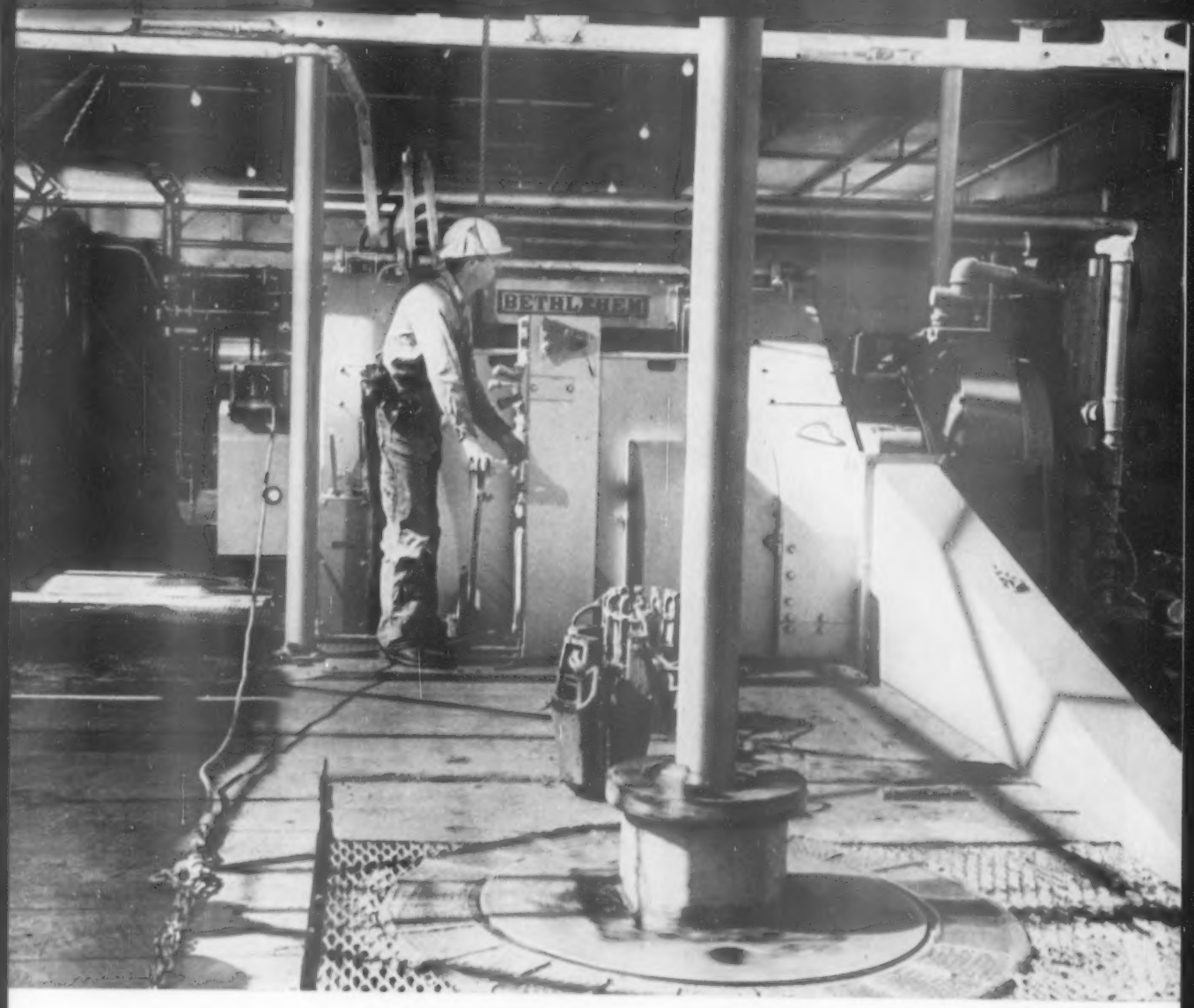
SEVEN major lithologic and lithologic-structural divisions can be recognized in the pre-Cambrian rocks of the Texas-Southeast New Mexico area (Fig. 1).

Texas craton . . . The most fundamental basement element is the Texas craton. It is a northwesterly elongated stable or cratonic mass composed mostly of plutonic igneous rocks of granite or granodioritic composition; locally there are patches of dioritic and babbroic rocks and of metamorphosed sedimentary and igneous rocks. Cataclastically altered rocks are developed (1) in a linear zone in southwestern Roosevelt County, New Mexico, (2) along the eastern edge of the Central Basin platform in Andrews and Ector counties, and (3) along the southern margin of the Fort Stockton high in Pecos County. Petrographically, the Texas craton is distinguished by its great volume of granitic rocks.

On the southeast the craton is delimited by the younger Ouachita fold belt and Balcones fault zone which have developed peripherally to it; on the north and west the craton passes out of the area of study and is partly concealed by the Panhandle volcanic terrane and complicated by younger intrusions of the Wichita igneous province; in the far southwest the craton is bordered by the Van Horn mobile belt which eastwardly, through unknown geologic relationships, gives way to the younger Ouachita fold belt; on the north and northeast the picture is vague, apparently the northern boundary is the Red River mobile belt. To the far west in New Mexico, meta-sedimentary rocks of varied grade and volcanic rocks indicate the approximate position of the cratonic margin, but poor control makes it difficult to establish a logical picture.

Part of the Texas craton is exposed in the Llano uplift of Central Texas where ancient metasedimentary rocks are intruded by granites of several ages. Evidence from this exposure and from gravity maps indicates that the southeastward part of the craton has a greater volume of metasedimentary rocks than the northwestern part. The latter is apparently composed almost entirely of plutonic rocks. Metamorphism increases from nothwest to southeast within the uplift. The gravity picture in the area of the Llano uplift is characterized by irregular or amoeboid

*This is an abstract of a recent publication, "Basement Rocks of Texas and Southeast New Mexico" by Peter T. Flawn, 261 pages, 2 text figures, 12 tables, 10 plates including 7 heliotype. Published by Bureau of Economic Geology, University of Texas, Austin 12, Texas. $2.50.



Making Hole Fast in West Texas

This husky Bethlehem drawworks was photographed making a lot of hole in West Texas. It's an M-810 for medium-deep drilling, and here it was keeping things very much on the go. You will always find this typical of the M-810, a rugged unit with exceptionally high clutch capacity (low-speed drum clutch, 102,000 ft-lb torque at 100 psi!). The rig can be furnished with mechanical drive, fluid coupling, or torque-converter; sectionalized engine compound is standard.

For depths in the medium range, Bethlehem offers a similar but smaller drawworks, the M-58. It too has very high clutch capacity: low-speed drum clutch, 59,000 ft-lb torque at 100 psi. In its size class there is no sturdier unit built. Compound is of sectionalized type so that the rig can be broken down into loads of required road widths. Drives: mechanical, fluid-coupling, or torque-converter.

Both the M-810 and the M-58 are standouts in their respective drilling ranges. For full particulars and operating data, we suggest you call our nearest office.

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anomalies that reflect the complex of granite and intruded metamorphic rocks; this picture changes northward and westward to a more regular pattern, although perhaps this is in part due to the masking effects of the thickening sedimentary cover.

Van Horn mobile belt . . . The concept of a pre-Cambrian mobile belt southwest of the craton in West Texas is based chiefly on the pre-Cambrian rocks that crop out in Culberson and Hudspeth counties in the Van Horn area. The Van Horn rocks have been described in detail by King and Flawn (1953). They consist of a metamorphosed sedimentary section, largely quartzofeldspathic, about 20,000 ft. thick intruded by rhyolite and diorite. These are also metamorphosed and thrust northward over a thick sequence of limestone, volcanic rocks, and sandstone that has suffered extreme deformation along a linear zone that is probably congruent with the cratonic margin. The nature of the original sediments, their thickness, and the character of the deformation, all suggest a deformed geosyncline or a mobile belt.

Red River mobile belt . . . This element is an east-west-trending subsurface belt of metasedimentary, metaigneous, and igneous rocks. It can be traced from Cooke County west to Floyd and Crosby counties and probably extends farther in both directions. Many of the basement wells in this area are localized in rather closely spaced groups on the structurally high Muenster and Electra elements of the Red River uplift—a late Paleozoic structural feature probably controlled by the older late pre-Cambrian mobile belt—and boundaries are difficult to fix.

From Denton and Cooke counties west to Foard County the belt is marked by a predominance of metasedimentary types. The western limit of the Red River mobile belt presents a problem. Probably the belt continues westward into Cottle and Motley counties and terminates in northern Crosby County, because metasedimentary rocks have been encountered in that area along the strike of the mobile belt. The uncertainty arises because another metasedimentary belt, the Fisher metasedimentary terrane, trends about north-south in the same area. It is separated from the metasedimentary rocks of the Red River belt in Motley and Cottle counties by a narrow band of granite. If the course of the Red River mobile belt is projected still farther westward it corresponds with the trend of the younger Matador structures. The pre-Cambrian rocks of the mobile belt as projected lie beneath the rhyolite flows of the Panhandle volcanic terrane.

Fisher metasedimentary terrane . . . The Fisher metasedimentary terrane is named for Fisher County, Texas, where, in the subsurface, it is well developed. Metasedimentary rocks have been encountered beneath Cambrian and younger strata in a wide arcuate area. This extends from northeast Nolan County north to Dickens County and includes parts of Scurry, Jones, Stonewall, Fisher, and Kent counties. Some evidence indicates that the metasedimentary rocks of the Fisher terrane are a northward subsurface extension of the metasedimentary rocks exposed in the Llano uplift.

Panhandle volcanic terrane . . . In the Panhandle and south plains of Texas and parts of Roosevelt, Lea, and Chaves counties of New Mexico, an extensive area is underlain by volcanic rocks. Locally associated with the volcanic rocks are dolomite and argillaceous siltstone. Seemingly these sedimentary rocks are intercalated in and rest on the volcanic sequence and represent sedimentary accumulations during quiescent periods in the volcanic cycle and thereafter.

Swisher gabbroic terrane . . . The basement rock in northeastern Roosevelt County, New Mexico, and Castro,

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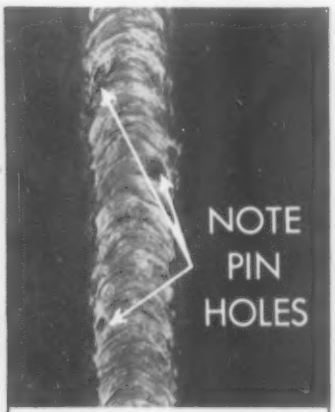

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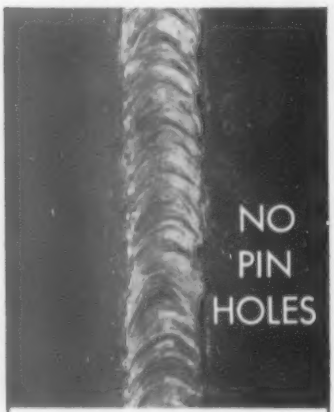

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"Major lithologic-structural divisions of the basement in general agree well with regional gravity trends . . . Gravity anomalies associated with the major Paleozoic structures cut across the older pre-Cambrian trends."

northern Lamb, Swisher, northern Hale, western Floyd, Briscoe, and western Donley counties, Texas, is mostly gabbro and diabase with subordinate related diorite. These mafic rocks comprise the pre-Cambrian surface in the greater part of the area that lies between two separated parts of the Panhandle volcanic terrane, and in some wells they are overlain by Cambrian or Ordovician rocks. Similar gabbro and diabase in the form of sills have been penetrated in the surrounding volcanic terrane. In some wells these gabbro sills in the volcanic sequence can be seen to have intruded and metamorphosed the sedimentary rocks intercalated with and overlying the volcanic rocks. Likewise, wells in the gabbroic terrane proper that did not encounter volcanic rocks also penetrate contact metamorphosed sedimentary rocks.

The gabbro terrane does not form a conspicuous high on the gravity map, and probably it is composed of a series of sheet-like intrusions instead of a deep-rooted mass. Some wells in the volcanic terrane penetrate interlayered gabbroic rocks and contact metamorphosed sedimentary rocks before encountering rhyolite porphyry; some wells in the gabbroic terrane penetrate similar gabbroic-contact metasedimentary sequences without encountering volcanic rocks. This suggests that perhaps this gabbrock terrane is, at least in some areas, no more than a thin skin overlying volcanic rocks beneath.

Wichita igneous province . . Zircon age determinations on the youngest granite series in the Wichita Mountains of southwestern Oklahoma show a late pre-Cambrian age of 670 million years. These Wichita Mountain igneous rocks and igneous rocks in the buried Amarillo Mountains of the Texas Panhandle are grouped together as the Wichita igneous province. The Wichita Mountains consist of a complex of granite and gabbro intrusions; in the buried Amarillo Mountains the rocks are mostly granite. In both areas the granites are commonly micrographic.

Age relations . . . The oldest unit is the Texas craton whose granites are dated at about 1,000 million years in the Llano uplift. The flanking Van Horn and Red River belts are younger features probably of late pre-Cambrian age. Rocks of the Panhandle volcanic terrane, Swisher gabbroic terrane, and Wichita igneous province are the youngest pre-Cambrian rocks in the area and may be part of the same igneous cycle. Age of the Fisher terrane is uncertain; it may be part of the craton and composed of relatively ancient rocks, or it may be a younger metasedimentary belt developed within the craton.

Conclusion . . . Major lithologic-structural divisions of the basement in general agree well with regional gravity trends. The margin of the craton and the Van Horn and Red River belts are clearly shown; rootless stratiform terranes are not separately reflected. Gravity anomalies associated with the major Paleozoic structures cut across the older pre-Cambrian trends.

It is suggested that the Texas craton was an independent continental nucleus during middle pre-Cambrian time and subsequently became a part of the larger Paleozoic North American Continent by growth through development of flanking orogens during late pre-Cambrian time.

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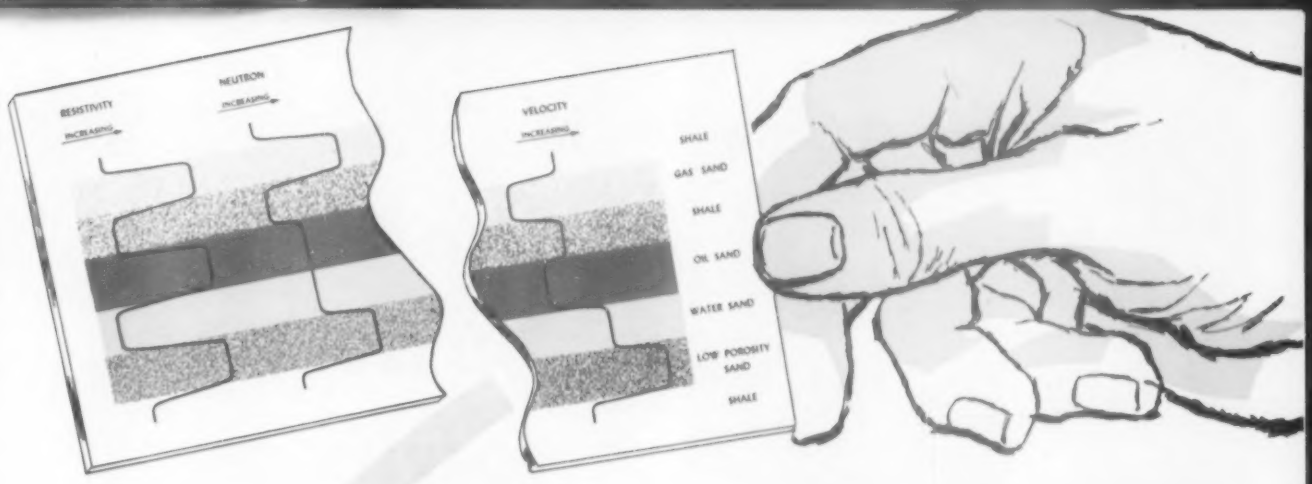

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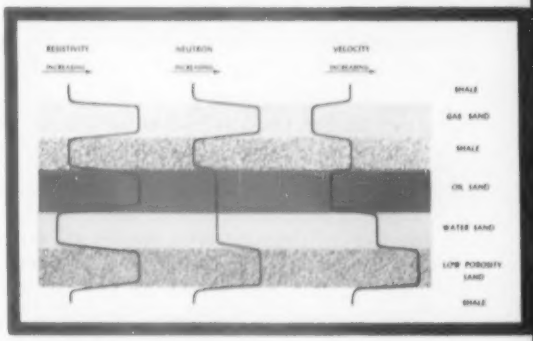
The idealized logs shown here are taken from material prepared by Warren G. Hicks of Magnolia Petroleum Company, and are based on his study of numerous logs obtained in the Miocene belt of the Texas and the Louisiana Gulf Coast. Here the velocity in sand is lower than in the adjacent shales, and the resistivity is higher. In this instance, according to Hicks, hydrocarbon saturation is almost certain to exist.



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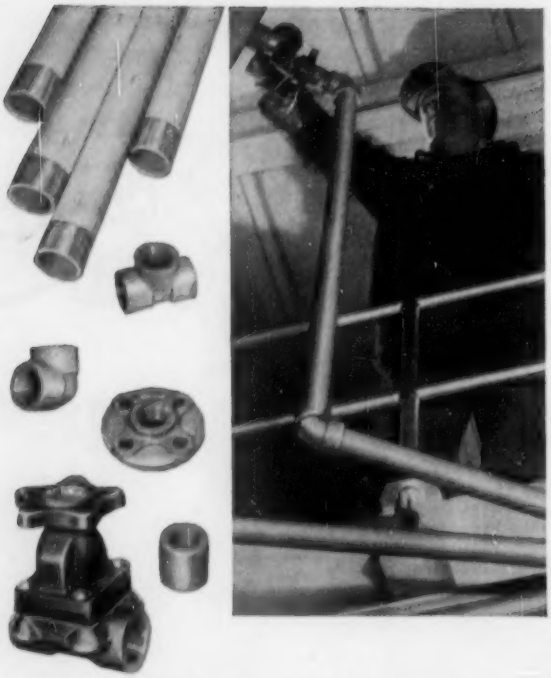

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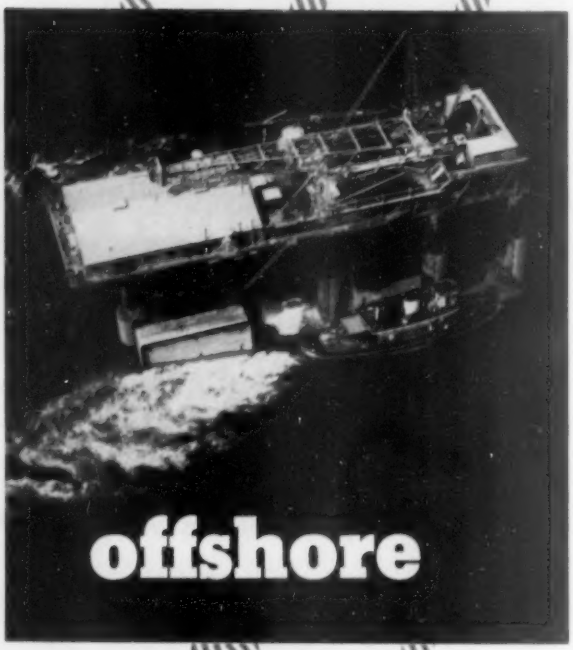

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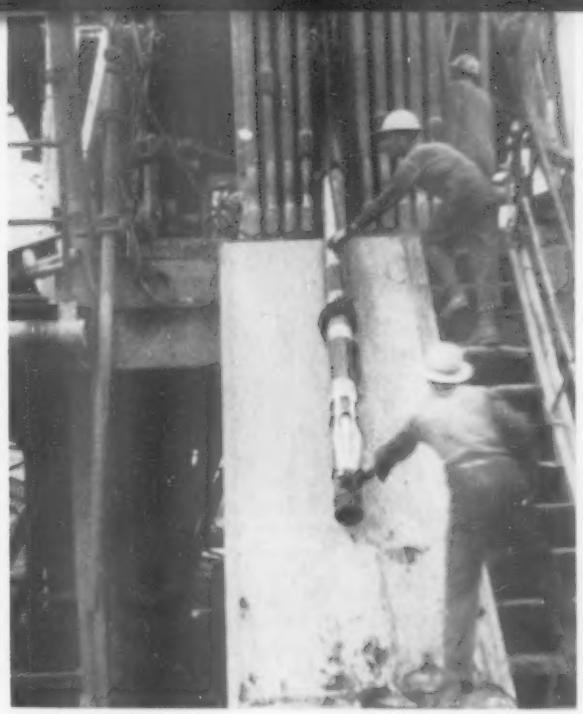
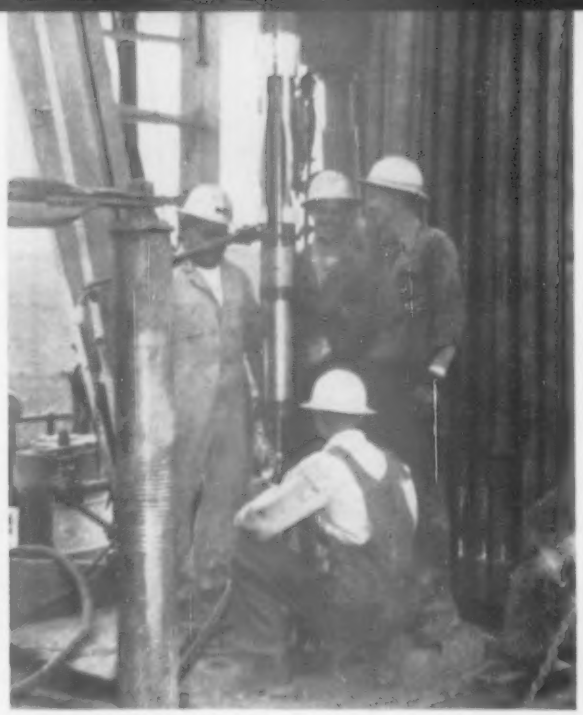


RIG CREW picks up a hanger to suspend 5½-in. pipe in 7⅝-in. protective casing on a Jefferson County, Texas, well. Notice the drill pipe hanging in the derrick. It will be used to lower the hanger and liner to bottom.



WITH THE LINER HANGING, rig crew prepares to couple it to the liner pipe already below the rotary. This Jefferson County, Texas, wildcat had a loss of circulation and it was important to get pipe into the open hole quickly.

Coast Operators Run Oil String in Two Sections

Here is the method some operators are using for running 7-in. long string inside deep 9⅝-in. protective pipe. It's getting good results on high-pressure wells where it's important to get casing to bottom in a hurry or where cement has to come all the way to the surface.

by Ed McGhee
District Editor

SOME Gulf Coast operators have made a change in their method of running long 7-in. oil strings. In deep wells that require an intermediate string of 9⅝-in. casing, the operators are running the 7-in. in two separate sections. The first is run as a liner in the open hole and then cemented. The second section is run later, attached to the first, and then cemented as high as necessary.

Here are the wells where the method helps:

1. Where hole trouble can develop if pipe is out of the hole too long.
2. Where formation pressure can cause a "kick" if pipe is out too long.
3. Where to "back up" the 7-in. against high pressure, cement must be carried higher in the well than is possible with conventional methods.

Intermediate string . . . In drilling below 12,000 ft., many Gulf Coast wells call for heavily weighted muds. The weight serves to prevent hole trouble in shale sections and to contain high-pressure or abnormal-pressure zones. However, many of the formations up the hole will not support the high fluid head. Loss of circulation would result. Therefore, an intermediate string of 9⅝-in. casing, usually 47-lb. or heavier, is run. Then an 8½ or 8⅝-in. bit drills the hole to total depth.

Production string . . . In the past, a full string of 7-in. o.d. casing was run in one section from the surface to total depth. The full string of 7-in. meant, of course, a high weight. Therefore, the 4½ or 5-in. drill pipe could not be left standing in the derrick; its weight added to that of the casing string would be an unsafe load on the supporting structure. Consequently, after the well drilled to total depth, the drill pipe had to be laid down in singles on the last trip out of the hole with the bit. The casing was then picked up in singles and run into the hole.

All this pipe handling resulted in a long lapse of time before the oil string reached the open-hole section. During this long interval, the hole could develop tight spots or bridge completely. It is reported that in some Gulf Coast areas casing got to bottom only about 50 per cent of the time.

Moreover, the time lag gives high-pressure zones time to cut the mud in the hole. Sometimes the casing had to be run when the hole was "running over."

As a liner . . . To get the production string into place in the open hole faster, drilling personnel of Stanolind Oil & Gas Co. decided to attempt running the bottom of the oil string as a liner. After cementing the liner, the top part of the production string, which represented the largest portion of the entire string, would then be run and cemented. Brown Oil Tools, Inc., developed the necessary tools and the trials were made successfully. Other companies have also been using the technique.

As the liner puts only a small part of the total 7-in. load on the supporting structure it is not necessary to lay down the drill pipe. This saves as much as 6 or 8 hours over laying down the pipe. The liner is then picked up and run into the hole. The drill pipe engages the top of the liner and lowers it to bottom. This, too, is fast and another 4 to 6 hours can be saved.

If all goes well, the 7-in. liner is in

place in the open-hole section before trouble has time to develop. It can then be cemented, and there is no further danger of stuck pipe or kicks.

Against high pressures . . . In Lake Arthur field of southern Louisiana, Union Oil & Gas Co. of Louisiana is using the two-section casing as a means to get cement behind the 7-in. all the way to the surface. The producing formation has an abnormal pressure; shut-in tubing-head pressure is about 9,000 psi. For that reason, Union of Louisiana backs up the 7-in. oil string with cement in case the tubing pressure is ever thrown on the casing.

The cement would not remain pumpable long enough to get it all the way to the surface on a full 7-in. string. Moreover, the high column of cement might have enough static head to fracture the exposed formations.

In record-deep well . . . Richardson & Bass used the two-section casing method in its record depth wildcat in Louisiana. In this well, 1 L-Humble-L.L.&E. State Lease 2414, the hole was open from bottom of the 9⅝-in. at 13,656 ft. to the bottom of the hole at 19,752 ft. It took only 12 hours to bring the bit off bottom in this well and get the liner sections into place ready for cementing.

Later on, this 7-in. was extended to the surface by a connector string.

In this same well, the operator used the same technique to set a string of 5-in. pipe inside the 7-in. As the liner section was being run, it hung up in the open hole. It could not be freed nor could circulation around it be established; so it was hung from the 7-in. casing without being cemented. However, Richardson & Bass then squeeze-cemented both the top and bottom of the liner before going on with completion attempts inside the 5-in.

The cement at the top of the liner was drilled out and many trips were made into the liner before it was completed with a connector string. Because of the small clearance between the 7-in. and the 5-in. connector string, the 5-in. string could not be cemented. Therefore, the connector tool was fitted with four lead and two Hycar seals. These sealed the two 5-in. strings together and sealed them against the 7-in.

In West Texas . . . A similar method was used by operators in West Texas during the steel shortage in 1952. The operators could not get the heavy-grade casing needed for the upper part of a deep oil string. The lightweight pipe that was available couldn't be depended upon to take the tension load. Therefore, the operators ran the bottom section of the string as a liner and cemented it. Then, when the upper part of the string was run, the tension load was low enough for the lightweight pipe to carry safely.

Potential casing saving . . . Another advantage of the two-section casing method shows in a recent Jefferson County, Texas, wildcat. The hole was cased to 9,089 ft. with a string of 7⅝-in. pipe, and 6⅝-in. hole had been drilled to 10,500 ft. There were promising looking sands in the open-hole section, so the operator decided to try completing in them. Accordingly, a string of 5½-in. o.d., 20-lb. per ft., flush-joint casing was readied to run into the hole as the oil string.

However, circulation could not be established with the 16.3-lb. per gallon mud. Mud weight could not be reduced because there had been salt-water flows with lighter muds. Because of this, the chances were great that conventionally run casing would stick before it could reach bottom.

The operator decided that if the 5½-in. were run as a liner, it should get to bottom before the hole would have time to bridge. Moreover, since it would run on the drill pipe, the drillers could pull harder on it if it should stick, thus improving the chances of freeing it. Of course, there would be better control with the drill pipe if the well should

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begin kicking before the liner could be cemented.

As a result, a bit cleaned out the hole to bottom and some 700 ft. of the 5½-in. was made up and run into the hole. It was lowered into place and hung without incident. Since there was some doubt about whether the sands behind the 5½-in. would produce, the operator decided to drill-stem-test them before running the upper section of casing. In case the zones should be dry, the upper section would not have to be run, thus saving the price of the pipe, attendant rig time, and cost of a cement job. Therefore, drill-stem tests were run on two sets of perforations in the 5½-in. Neither showed commercial production.

However, there was a zone behind the 7⅝-in. pipe which did produce on test. Since its pressure was not too high to impose on the 7⅝-in. casing, the operator did not complete the 5½-in. string. And the cost of the upper section was saved.

Not for all wells . . . Operators who use the method say that it is not needed on all wells. It is for deep, high-pressure wells only.

Basically, this method uses shallow-well casing repair techniques adapted to deep-well operation. There are two drawbacks to it. First, it requires 1 to 2 days more rig time than the old method. Most of this time is in waiting for cement to set on the liner section. Second, the special hanger and patch tools are costs that do not enter the conventional strings. The same is true for the second cement job on the upper section. Despite these added costs, the companies feel that the benefits of the method more than justify it.

Running the Liner

On the first wells where the liner method was tried, Stanolind ran a wire-line retrievable float. This float, adapted from the design of a retrievable drill-pipe float, stopped backflow while the liner was being run, but required much time to retrieve. Therefore, another type of float is now used that is kicked permanently open by briefly pumping down through it.

With the casing open, the liner is lowered to bottom on the drill pipe. The drill pipe does not backflow because the running-in tool provides a bypass at the top of the liner with enough opening to relieve the mud.

When the liner reaches total depth, the bypass is closed and the liner is cemented as desired. A cement wiper plug is carried in the liner. When the drill-pipe wiper plug reaches the liner, it seats in the liner plug, and the two travel together to bottom and latch there. The drill pipe is freed from the liner, and excess cement is reversed out.

The first liner-hanger tools did not carry a packoff to seal against the 9⅝-in. intermediate string. Presently used tools do carry a packoff and thus increase the chance for a good cement job on the liner.

With the most recent tools the liner is hung so that it is to be engaged by a spear tool on the end of the connector string. The top of the liner is cleared by reversing circulation after cementing, so that a trip with a wash-over shoe is not necessary. Consequently time is saved in getting the connector string into place. Moreover, the design of the tools permits good flow between them and the 9⅝-in. casing.

The connector string . . . Running the upper section is like any other casing job except for the connector tool on bottom and an orifice collar. A positive float would trap fluid in the top of the liner and prevent complete entry of the connector.

When the connector string is nearly in place, cement is displaced in the usual manner. Then the string is set down into the liner for the permanent connection. In the connector tool is a packoff that seals against the liner. The result is a connection that is completely flush on the inside and as strong as the pipe itself.

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The "quotes" are the enthusiastic comment of the operator when asked about the performance of this trailer-mounted pumping unit. He stated further that it was practically trouble-free, light in weight, and that he could always count on it for handling a wide range of jobs.

The Unit consists of a VG4D Wisconsin Power Unit direct-connected to a 2" rotary pump with a capacity of 14 BHP at 1000 lbs. and 70 BHP at 400 lbs. The Wisconsin Air-Cooled Power Unit is equipped with a heavy-duty transmission which has several speed ratios, reverse and neutral.

Shown here testing a pipeline in southern Oklahoma, this unit is also used to pump crude oil of various viscosities into pipe lines having a wide range of pressures.

This is just another typical oil field application of Wisconsin Heavy-Duty Air-Cooled Engine Power . . . extensively used for operating oil well pumps, gathering pumps, tar kettles, pipeline padding machines, standby power units, and many other kinds of oil field utility equipment requiring dependable power in a 3 to 36 hp. range.

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THE WORLD'S LARGEST INDEPENDENT OILFIELD SUPPLY AND SERVICE ORGANIZATION

by W. L. Nelson
Technical Editor

QUESTIONS ON TECHNOLOGY

Equivalency of Some Color Scales

What is the equivalent of a four color by the Institute of Petroleum Method and the Saybolt Chromometer color?—F.G.H.

The relationship between arbitrary color scales such as those of the Chromometer and the I.P. scale and, in fact, all such scales, cannot be stated precisely because of the different shades, hues, tints, etc., encountered. The Lovibond Tintometer eliminates most of these difficulties but such an elaborate method is not justified in most commercial testing. However, the relationships shown in Table 1 indicate the general relationship (D. T. Day, Handbook of the Petroleum Industry, Vol. 1, page 663; Cross, Handbook of Petroleum, Asphalt and Natural Gas, pages 620-626; and Anon, The Oil and Gas Journal, January 28, 1952. An I.P. color of 4 corresponds approximately to a Saybolt Chromometer color of plus 12.

Helium Extraction

Do you have in your files a flow diagram of a plant for helium extraction? J. D.

No flow diagrams are available to this department but undoubtedly the U. S. Bureau of Mines can suggest a suitable flow diagram. However, the Bureau of Mines Navajo plant in New Mexico was described in some detail in the July 28, 1945, issue of The Oil and Gas Journal, page 130. In addition, Information Circular I.C. 7344 April 1946 of the Bureau of Mines entitled, "The Properties and Uses of Helium," lists 912 articles on helium. C. W. Seibel, of the USBM, has been active in such work.

The great advances made during recent years in the liquefaction of oxygen and of ethylene, should contribute much to the economy of helium-recovery operations. Bulletin 486 of the USBM entitled, "Helium-Bearing Natural Gases in the United States" (1951), shows analyses of more than 2,000 natural gases. The amount of helium in these samples is about:

over 7 per cent	21 approx.
3 to 7 per cent	6 approx.
1 to 3 per cent	144 approx.
under 1 per cent	rest

TABLE 1—COMPARISON OF COLOR SCALES

Saybolt Chromometer numbers	Institute of Petroleum numbers*	Color names	A.S.T.M. and N.P.A.† numbers	Union Pet. Co. letters	Tagliabue Robinson numbers	Lovibond color analysis (12-in. cell except 1-in. for amber) Red 200 series	Yellow 510 series	Amber 500 series‡	Blue 1180 series
30									
25		Water white					0.32		
24	1	Water white							
21	1½	Water white					2.0		
19	2	Superfine white							
17	2½	Prime white							
16		Prime white				1.02	4.0		
15	3	Prime white							
14	3½	Standard white				1.1	4.0		
12	4	Standard white				1.1	5.0		
11	5	Standard white							
10	6	Standard white							
9	7	Standard white							
8		Standard white				1.1	6.0		
6		Standard white				1.0	7.0		
3		Standard white				1.2	9.0		
1		Standard white							
— 2						1.1	14.0		
— 4						1.1	15.0		
—11		Lily white	1	G	20¾	0.12	2.4	(1.4-1.9)‡	
—16						1.1	27.0		
—24		Cream white	1½	H	17½	0.6	8.0	(5-7)‡	
—28						25.5	27.0		
—32		Extra pale	2	I	12¼	2.5	26.0	(20-23)‡	
		Extra lemon pale	2½	J	10	4.6	27.0		
		Lemon pale	3	K	9½	6.9	32.0	(50-63)‡	
		Extra orange pale	3½	L	9	9.4	45.0		
		Orange pale	4	M	8½	14.0	50.0	(110-125)‡	0.55
		Pale	4½	N	5½	21.0	56.0		0.55
		Light red	5	O	3¼	35.0	93.0	(220-250)‡	
		Dark red	6	P	2	60.0	60.0	(300-340)‡	0.55
		Claret red	7	Q	1¼	60.0	106.0		1.8
			8	R		166.0	64.0		
		Extra light§	A	A		10.2	29.0		
		Light§	D	D		21.0	31.0		
		Medium§	E	E		89.0	56.0		

*Approximate relationship to Saybolt color. †National Petroleum Association. ‡Used alone without other color disks. §For filtered cylinder stocks.

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Accelerated treatment of such wastes has been a prime objective of INFILCO for over 60 years. You will find INFILCO equipment, with many exclusive features, includes the most efficient, compact units on the market today. Whatever your need, there is *high-rate* INFILCO equipment to meet it. Here are typical examples. You can depend on these units to—

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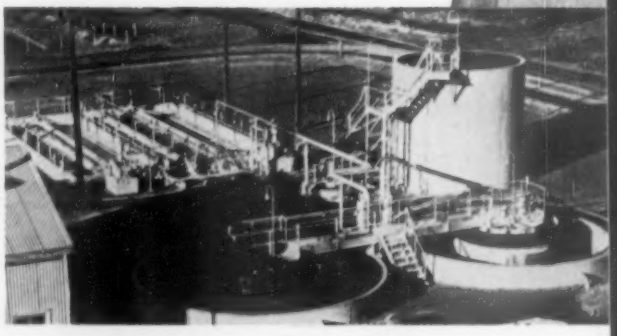
- ***provide uniform and flexible treatment***

It will pay you to consult INFILCO about waste problems because INFILCO KNOWS HOW to help you solve them. Write today for complete information.

Inquiries are invited on all waste treatment problems.



High-rate biochemical oxidation. Oil refinery phenolics and other organic pollutants are rapidly oxidized in AERO-ACCELATOR® plants. *Bulletin 6510.*

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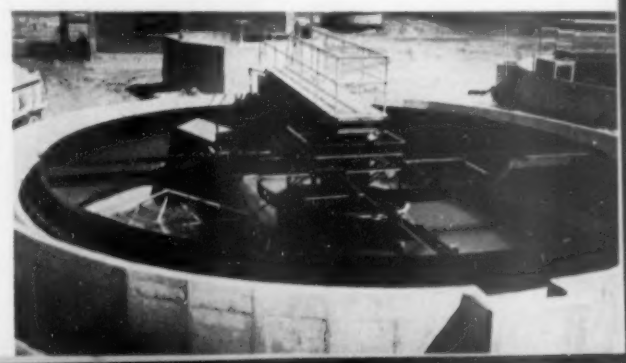

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5620

PORTABLE-GASOLINE-PLANT SYMPOSIUM

Designing a Midget Plant for West Texas—3

by F. H. Lacy, Jr., and G. B. Evans

BECAUSE the inlet scrubber is at substantially atmospheric pressure, any inlet-scrubber condensate is lift-trapped to drip storage. First-stage condensate also moves by lift trap to the second-stage scrubber. Second-stage condensate from the second-stage scrubber is pumped to the water-gasoline separator, where it is commingled with the third-stage-compressor discharge stream which has been air cooled. At this point, all water which has been condensed is drained.

After removal of water, glycol is injected into the stream to prevent hydrate formation. Then, after water-cooling and after heat-exchange with the cold gas from the raw-product surge tank, this stream passes into the chiller where it is chilled to about 35° F. From the chiller, the stream then passes to the raw-product surge tank for separation.

From the raw-product surge tank, uncondensed and dehydrated hydrocarbons (sales gas) pass through the chiller-exchanger to the sale-gas pipeline. Water-glycol mixture is removed from the surge tank and passes to the glycol regenerator. Hydrocarbon condensate (raw product) is fed to the deethanizer and is flow controlled with a flow controller which is reset by a liquid-level controller located on the raw-product surge tank. Pressure on the raw-product surge tank is held high enough to cause the raw product to flow, without pumping, to the deethanizer.

In the deethanizer, ethane and lighter hydrocarbons are fractionated overhead and enter the fuel-gas system. The deethanizer is held at a pressure higher than the sales-gas pipeline pressure so that any overhead gas in excess of fuel-gas requirements will join the gas stream from the raw-product surge tank and flow to the sales-gas pipeline.

The deethanizer is a packed tower and is fed at the column top. The reflux condenser is mounted above the column and all hydrocarbons condensed therein are returned to the column as reflux. Deethanizer overhead is chilled in the reflux condenser to 35° F., which is substantially the same temperature as hydrocarbons from the chiller. The entire refrigerant stream passes through the deethanizer reflux condenser before going to the chiller. The deethanizer top-temperature controller acts to reset a pressure controller located on the refrigerant stream between the deethanizer reflux condenser and the chiller. Reboiler heat medium (Para-Cymene) is flow controlled, and this flow controller is reset by the flow controller located on the deethanizer feed stream.

Propane and heavier fractions from the deethanizer pass into the depropanizer, a 40-tray column, for fractionation into 95 per cent propane as an overhead product, 14-lb. R.v.p. gasoline as a bottom product, and 100-lb. R.v.p. L.P.G.-mix as a side-cut product. The latter is further fractionated in a side-cut stripper.

Temperature control . . . Top temperature of the depropanizer is controlled with a temperature controller by regulating the reflux pump. Para-Cymene from the depropanizer reboiler is flow controlled. This flow controller is reset by the flow controller on the depropanizer feed. Temperature of the depropanizer base is controlled by a temperature controller which regulates the rate of feed to the side-cut stripper. Temperature of the base of the stripper is controlled by a temperature controller that regulates the stripper-reboiler heat medium.

Propane is used as the refrigerant in the plant. After one stage of compression, it is condensed in a water-cooled condenser and collected in the refrigerant accumulator. From the refrigerant accumulator, it flows through the refrigerant exchanger, then through the depropanizer reflux condenser to the chiller shell. The flow is regulated by a level controller on the chiller. As previously mentioned, a pressure controller, reset by a temperature controller, controls the pressure (and therefore the temperature) of the propane through the deethanizer reflux condenser. From the chiller shell, propane vapor passes through the refrigerant exchanger to the refrigerant compressor cylinder. The refrigerant exchanger serves the dual purpose of conserving horsepower and insuring that any liquid propane which might possibly be carried over cannot reach the compressor cylinder as liquid.

Para-Cymene is used as the heating medium in the plant. A two-drum vaporizer is used to vaporize the material and operates at a pressure of about 8 psig. This system, although not exactly conventional, has been extremely satisfactory in its performance.

All pumps other than those driven directly from the compressor engine are reciprocating and are driven by the expansion of fuel gas. Fuel gas from the deethanizer (at 475 psig.) is heated (by jacket water) and expanded to 150 psig. Whatever gas is required then passes through the power ends of the pumps to the fuel-gas system, which is held at about 30 psig. Any additional fuel gas required is vented directly to the fuel-gas system through a pressure regulator.

Authors are with Honolulu Oil Corp. Paper presented at the thirty-fifth annual convention, N.G.A.A., Fort Worth, April 11-13, 1956.

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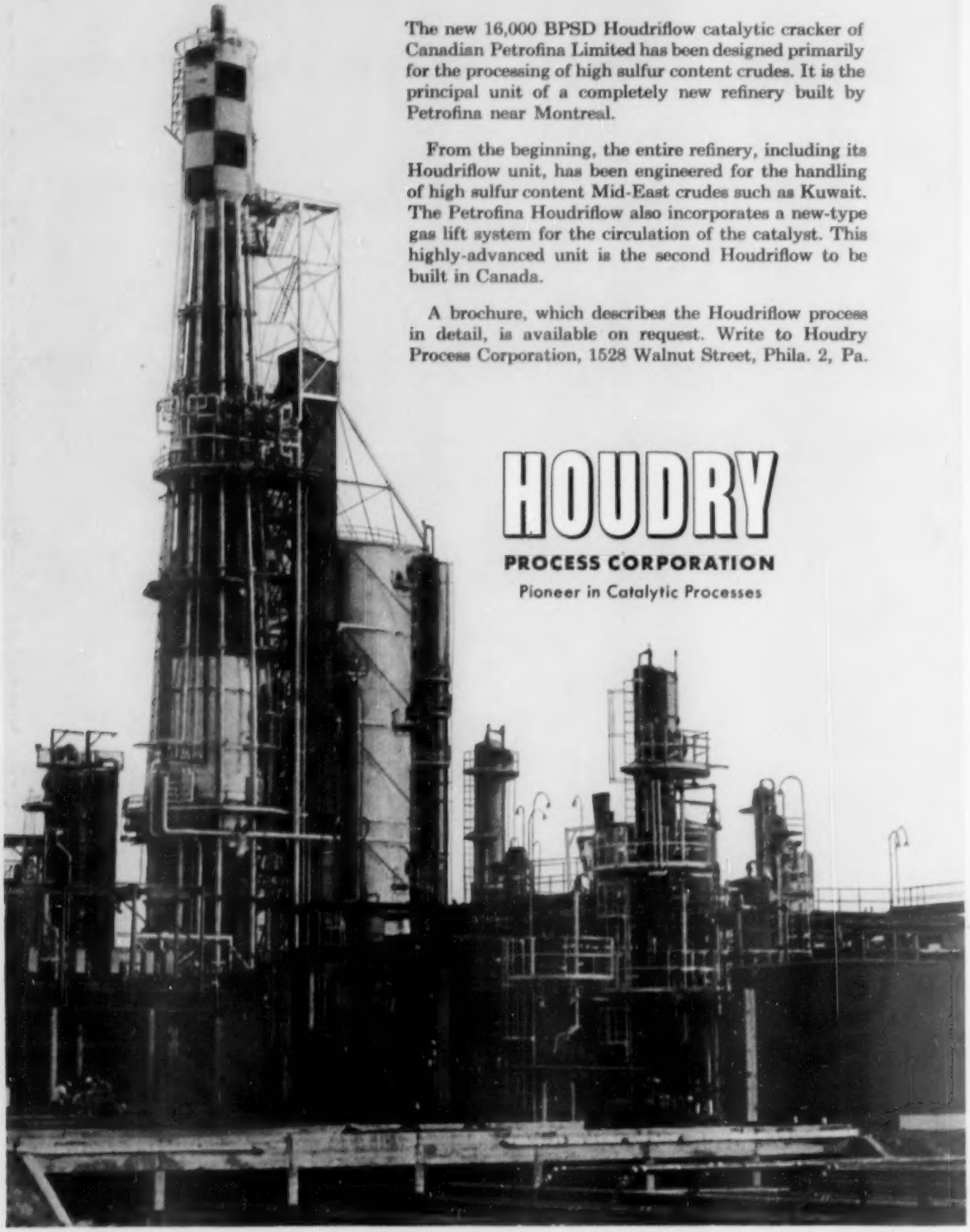

The new 16,000 BPSD Houdriflow catalytic cracker of Canadian Petrofina Limited has been designed primarily for the processing of high sulfur content crudes. It is the principal unit of a completely new refinery built by Petrofina near Montreal.

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A brochure, which describes the Houdriflow process in detail, is available on request. Write to Houdry Process Corporation, 1528 Walnut Street, Phila. 2, Pa.

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Contamination Index—4

Precautions in Finding the Contamination Index

by J. J. Watt, B. G. Martin, and W. H. Still

CORRELATION charts between Contamination Index and Tag C.T. flash results provided in the method are useful for field operations (Figs. 5 and 6). For purposes of simplification, the volatility of the gasolines are identified by their Reid vapor pressures.

Precautions that must be exercised, and the limitations that must be recognized in the Contamination Index method are as follows:

1. The combustible gas indicator should be periodically and carefully standardized against n-pentane.

2. The indicator should be free from any vapor or material from previous tests.

3. If liquid is drawn into it by error, the indicator should not be used until it has been completely cleaned and standardized.

4. A representative sample must be obtained.

5. The Contamination Index should be taken immediately after the sample is prepared. One determination only should be made on each sample.

6. The temperature of the test sample must be taken immediately after the meter reading is obtained.

7. The prime factor in correlations between Contamination Index and Tag C.T. flash is the composition of the lighter constituents of the gasolines. These are the component parts that have a marked influence in the A.S.T.M. Reid vapor pressure of gasolines.

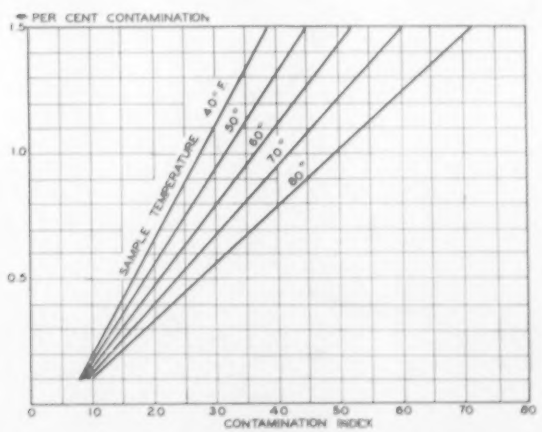
8. Gasolines of different compositions (or sources) will produce different correlations.

Authors are with Atlantic Refining Co., Philadelphia.

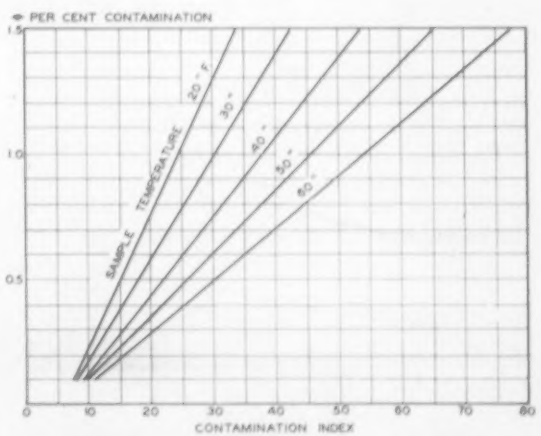
Instruments used . . . The combustible gas indicator and the M.S.A. Explosimeter, Model 2, are calibrated with and are sensitive to volatile hydrocarbon gases that are normally found in gasolines. They are, therefore, natural instruments for estimating contamination of less-volatile products with gasoline. There are two variables which need to be known to effect positive control: (1) the relative composition of the volatile material; and (2) the quantity of the volatile material present which reduces the Tag C.T. flash below the established minimum level.

During loading and unloading operations at terminals, or in product pipeline operations, contamination when it occurs does so rapidly. Thus, for many situations, the use of the Contamination Index method might be limited to indicate that contamination has or is taking place. Correlations with Tag C.T. flash points might not be necessary or desirable in certain circumstances.

The combustible gas indicator can be utilized in a continuous operation for the detection of gasoline contamination of distillate burning oils. Various types of alarms could be actuated for informing operators or for controlling the flow of materials in lines.



CONTAMINATION as a function of Contamination Index for distillate burning oils contaminated with 9-lb. R.v.p. gasoline. Fig. 5.



CONTAMINATION as a function of Contamination Index for distillate burning oils contaminated with 12-lb. R.v.p. gasoline. Fig. 6.

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"When I want a **3-CUTTER BIT**

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Small Rotaries Invade Cable-Tool Domain

Cable-tool drillers are eying the performance of these two small rotary rigs that Overby Drilling Co., of Nowata, is operating in the Nowata water-flood area of northeastern Oklahoma. Using air instead of mud, these rigs are working successfully alongside cable tools. This area long has been strictly cable-tool operation.

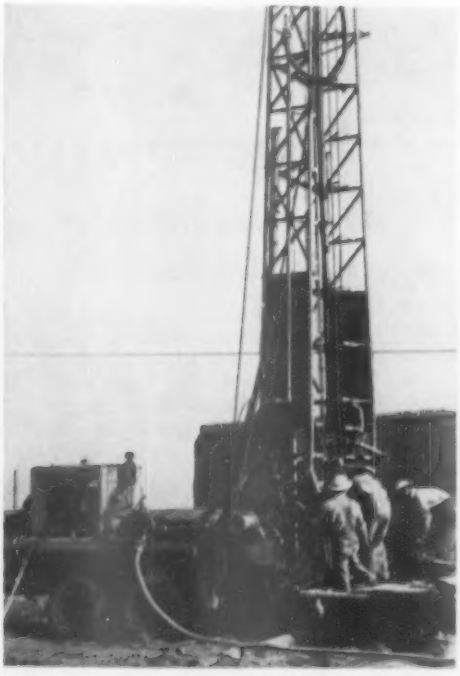
The smaller of the two rigs (right photo, this page) was designed originally for shot-hole drilling, but has drilled nearly 125,000 ft. of hole for Climax-Brundred Waterflood Division of Climax Molybdenum Co. It is currently being used for both production and input wells to depths of 300 to 400 ft. Wells can be put down in an 8-hour tour, and completed within 24 hours.

The rig, a Mayhew 1000, is equipped with both a mud pump and an air compressor. The compressor now in use can deliver 600 cu. ft. per minute. The regular compressor, with a capacity of 300 cu. ft. per minute, was found insufficient to handle cuttings and water.

The larger of the two rigs is a Mayhew 2000 (left photo). It is powered by an International 450, mounted on the truck bed between the mud pump and the mast. If necessary, the truck motor, also an International 450, can be used for additional power in drilling operations. This rig handles doubles when changing a bit, but the lengths of drill pipe are only 20 ft. long. With normal drilling operations, the 2000 unit uses 3½-in. drill pipe and 5-in. drill collars. Overby Drilling Co. runs four drill collars behind the bit, giving a weight of about 5,000 lb. In addition, the unit has an automatic pulldown that adds another 5,000 lb. to the bit, if needed. The large unit has occasion to use two air compressors when drilling the 700-ft. wells. The larger compressor will deliver 600 cu. ft. per minute and the smaller will boost the total air volume to 915 cu. ft. The mud pump is a 5-in. by 8-in., but it is seldom used.

Water, main problem in air drilling operation at greater depths, does not seriously interfere with these small rotaries. The rigs have handled water sands with volumes as great as 1,000 bbl. per day or even larger.

The Mayhew 2000 is currently used for drilling to 650-750 ft. Most of



These small rotaries are competing successfully with cable tools in the water-flood area of Nowata County, Oklahoma. Drilling depths range from 350 to 800 ft.

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Trying to break out galled and seized new tool joints often results in bent drill pipe. You can prevent this by making up new joints with 'Bestolife Lead Seal. 'Bestolife provides the necessary film strength and metal cushioning to prevent galling and seizing during the critical break-in period—and permits easy break out. This means long, economical life for tool joints. 'Bestolife is stocked by leading supply houses the world over. In 1¼, 5, 20 and 50 lb. cans. Unconditionally guaranteed.

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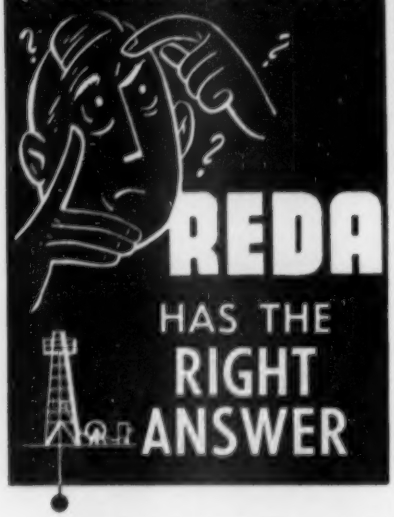

. . . from ⅓ HP to 300 HP . . . from 20 bbls to 25,000 bbls . . . from 200' to 10,000' and more . . . Yes, a REDA will do that pumping job BETTER . . .

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these wells require a total time of about 36 hours from move to move. Drilling requires about 18 hours; moving, cleaning out, and completion take up an additional 18 hours. The doghouse is a trailer similar to those used by trucking companies on long-distance hauling. In the rear of this trailer are the light plant, the butane tank, and the two-way radio. The front end is used as a change-house.

An interesting feature of the "big rig" is the set of controls for either air or mud drilling. The driller simply turns a control valve and converts immediately from air to mud. Usually, however, when water is encountered, the driller simply adds a few barrels of water to the air stream, using the mud pump.

Dixilyn Drilling Co., Odessa, Tex., has a new offshore job scheduled for Gulf Refining Co. in the Timbalier Bay area, Lafourche Parish, Louisiana. It is a 12,500-ft. test at 1-C State Lease 1483, in Block 6, Bay Marchand area, Gulf of Mexico. It is about 2 miles south of Timbalier Bay production.

Gibson Drilling Co., Kilgore, Tex., has a new wildcat operation ½ mile west of Mixon, in Cherokee County, East Texas. It is a contract job for R. L. Gibson, of the contracting company, and B. K. Thomas. Location is at 1 Kirby, in the F. J. Anthony Survey. Hole will be carried to the Woodbine around 4,500 ft.

Atlas Drilling Co., Opelousas, La., has contracted for an 11,500-ft. test on the northeast flank of Gueydan field, in northeastern Vermilion Parish, Coastal Louisiana. It will be drilled for Arnold H. Bruner, of Dallas, and Charles H. Lawrence, Jr., of Lake Charles, La. Permit is for 1 B. W. Evans Unit 1, in 27-11s-1w.

Crow Drilling & Producing Co., Shreveport, is drilling on contract at a wildcat test on Tew Lake, 4 miles north of Jonesville, in Catahoula Parish, eastern Louisiana. It is a 5,500-ft. Wilcox job for Durbin-Bond & Co., Little Rock, Ark. Location, at 1 Davis-Ford, in 11-8n-6e, is 3½ miles northwest of West Pool Lake field.

Harry L. Edwards Drilling Co., Houston, will drill Union Oil Co.'s projected wildcat test in the Four League Bay area, in Terrebonne Parish, Louisiana Gulf Coast. The test, 1 State Lease 2784, in Four League Bay, is about 3 miles south of Halter Island field, nearest production. It is set up for 12,000-ft. drilling.

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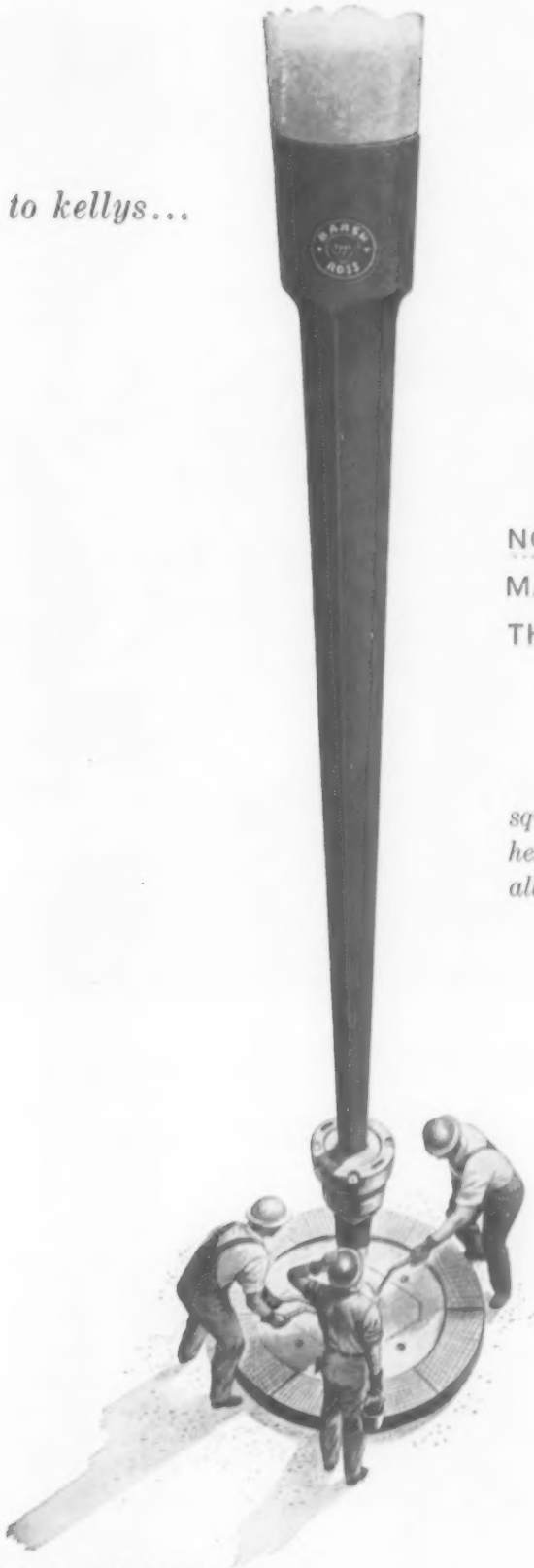

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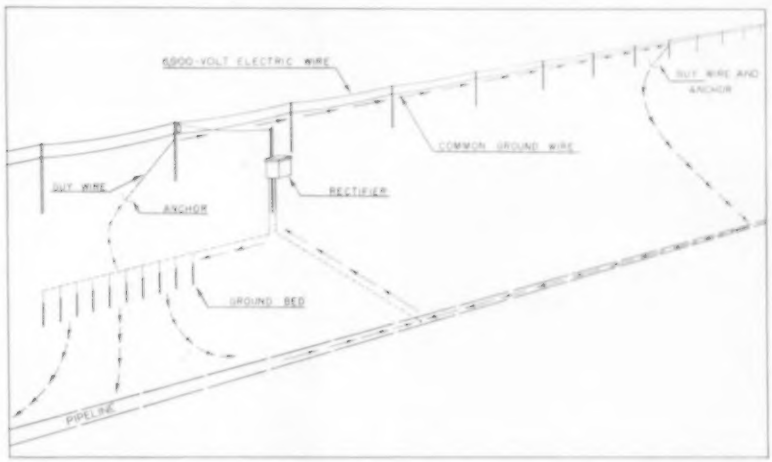

FIG. 1—How pole-line fixtures can suffer cathodic interference from pipeline-protection units.

Which—rectifiers or anodes?

Here's a new approach in choosing

The author contends that right-of-way conditions—and not conventional methods of comparative costs—can best determine the exact method of cathodic protection to use. Here's the reasoning behind this approach.

by W. E. Huddleston

THE matter of selecting anodes or rectifiers for cathodic protection of pipelines is one of the most important general problems that arises in corrosion engineering. Yet it is one of the most interesting. The question of whether to use anodes or rectifiers is most often asked by executives and other individuals who have studied the fundamentals of corrosion prevention only enough to have a general knowledge of the subject.

We have faced this particular problem on many pipelines operating under a wide variety of conditions. Noting the results obtained over long periods of time, we conclude that in general the best approach to the problem primarily involves present and future conditions of the right-of-way.

This is contrary to the present conventional method of estimating comparative costs between the two methods. But it is valid because the long-term costs by either method are about the same, under comparable right-of-way conditions.

The phrase, right-of-way conditions, pertains to the **physical features** of the pipeline and also to its physical environment.

Any one or a combination of several factors involving right-of-way conditions can (and usually does) govern the selection of the most economical type of fixture for applying and maintaining cathodic protection. It is necessary to elaborate on the subject of right-of-way conditions in order to support this line of reasoning. First, however, in the comparatively few cases wherein prevailing right-of-way conditions do not dictate the choice of fixtures, the selection of anodes or rectifiers becomes more or less arbitrary. This statement generally holds true because the overall cost of long-term cathodic protection by the two methods is substantially the same—right-of-way conditions permitting.

Author is consulting corrosion engineer, Box 98, Bartlesville, Okla. Paper presented at third annual corrosion-control short course of the N.A.C.E. and the University of Oklahoma, Norman.

Important Right-of-Way Considerations

In view of the importance attached to right-of-way considerations in the solution of our specific problem, let's discuss these factors somewhat in detail.

With most technical problems, the more data and facts that are available, the more satisfactory the solution will be. The engineer must appraise the situation diligently and thoroughly.

Accordingly, right-of-way conditions should be investigated by making a systematic survey, and getting complete information about physical features of the pipeline and its environment. Physical feaures include type and specifications of coating, loops, lateral connections, major stream crossings, etc.

Some of the most important items pertaining to the physical environment include: (1) fire and explosion hazards; (2) the presence of foreign underground metallic structures; (3) the presence of stray d.c. currents; (4) existing "open wire" communication facilities; and (5) other special considerations which will be discussed later.

In most pipeline corrosion problems, at least one of the above listed factors will prevail. Any one of these items might very well be the determining factor in arriving at a decision to use anodes or rectifiers.

Fire and explosion hazards . . . Severe consequences might result from improperly engineered cathodic protective systems.

We refer specifically to the possibility of a spark occurrence that might set off a costly fire or explosion. While this hazard can normally be disregarded when using expendable anodes, it must certainly be kept in mind when considering rectifiers.

The use of explosionproof rectifiers definitely will not preclude the possibility of spark occurrence. Quite obviously, a spark will occur when the external circuit of a sufficiently loaded rectifier is "opened" or "closed"—accidentally or otherwise. Conceivably, then, the corrosion engineer might at once condemn the use of rectifiers for cathodic protection in cases where hazardous conditions would prohibit their use.

Foreign metallic structures . . . This classification pertains to underground metallic structures that might be adversely affected by cathodic-protection rectifiers. The most important structures are: pipelines; conduits; telephone and power cables; oil and gas-well casing and tubing; pole-line fixtures; and sometimes steel reenforcing in concrete foundations of bridges, buildings, etc.

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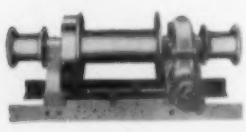

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damage by cathodic interference, and sometimes to the extent of mutual interference. Indiscriminate use of cathodic-protection rectifiers may result in very costly damages, and subsequently in litigation proceedings.

Refer to Fig. 1 for an illustration of the general mechanism of cathodic interference. It is well-known that a loaded ground bed will elevate the potential of the surrounding soil as well as the potential of the adjacent metallic structures that are in contact with the closely surrounding soil. Thus, it is possible to damage neighboring structures, such as pole-line fixtures, by electrolysis from cathodic-protection current.

The damages to pole-line fixtures from cathodic interference are usually less extensive than to other structures. Also, the engineer usually knows how to avoid or compensate for damages in this particular contingency. For these reasons, the engineer will seldom permit the matter of cathodic interference to deter his plans for installing rectifiers (in this particular case) if other reasons indicate that the selection of rectifiers for cathodic protection is advisable.

Stray d.c. currents . . . The presence of stray d.c. currents introduces many technicalities where pipeline protection is concerned. Accordingly, the preliminary-survey results might disclose the futility of attempting to eliminate electrolysis with expendable anodes. Corrosion from electrolysis is normally severe. A survey of right-of-way conditions will usually dictate an immediate decision on the selection of rectifiers or anodes for pipelnes that are situated in stray-current areas.

Communication facilities . . . Cathodic rectifiers are inherently "rich in harmonics" and may, therefore, induce intolerable noise and interference on adjacent open-wire telephone circuits. So it is necessary to exercise discretion when planning a rectifier installation that will be situated near open-wire lines. Usually, it is possible to eliminate harmonic interference by using filtering devices. The corrosion engineer will do this if the right-of-way survey shows rectifiers are otherwise preferable to anodes.

Special Considerations

It is apparent, then, that certain right-of-way technicalities often govern the selection of anodes or rectifiers for cathodic protection. Some of the non-technical factors that might affect a decision are: (1) relations with property owners; (2) existing crops and subsequent damage costs; (3) additional easements required for the installation of cathodic protection; and (4) the presence of facilities that would not be harmed by cathodic interference but would require special attention during installation and maintenance of cathodic protection.

Relations with property owners . . . Almost every pipeline operator tries to maintain good relations with the owners of properties on which the pipeline is situated. Despite this, there are circumstances wherein relations are such that it would be highly undesirable to install cathodic-protection facilities—especially in cases that would necessitate periodic maintenance.

Crops and damages . . . Growing crops along the pipeline right-of-way must be considered from the standpoint of subsequent damage costs. In certain cases, anodes or rectifiers can be installed after harvest so that damages are nil or at least minimized. Other circumstances might dictate the use of remotely situated rectifiers so that certain crop lands are entirely unaffected.

More easements . . . Right-of way contract stipulations might permit the installation of anodes or rectifiers without buying additional easements. On the other hand, it might be necessary to purchase additional easements for installing even a few closely situated expendable anodes. The matter of right-of-way agreements should be investigated thoroughly. The stipulated width of the right-of-way is a very important factor—especially in connection with anticipated use of expendable anodes.

Right-of-way obstacles . . . Certain right-of-way objects might be unaffected entirely by the presence of cathodic protection. Yet potential damage during the installation might be enough to govern whether rectifiers or expendable anodes would be used. Such objects include tile drainage systems, irrigation ditches, canals, and sometimes earth work such as terraces, dykes, ponds, lakes, and special water ways.

Future right-of-way conditions . . . It is impossible to predict future changes in right-of-way conditions with any degree of accuracy. But the engineer certainly must consider this possibility when pondering over the selection of rectifiers or anodes. Some of the most ordinary changes of right-of-way conditions involve such matters as real es-

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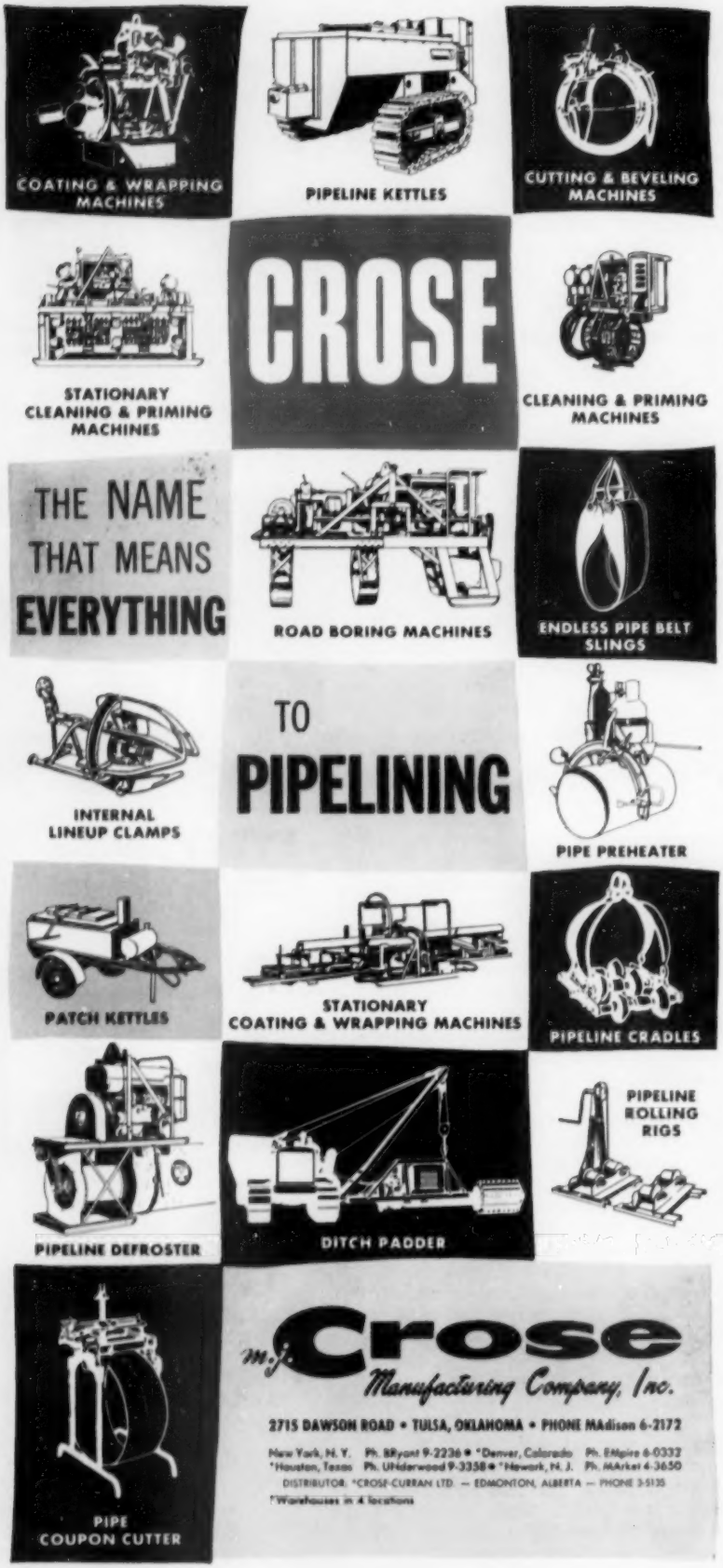
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tate and housing developments; construction of new pipelines across or parallel to the existing pipeline right-of-way; and the laying of telephone toll cables.

Summarizing the problem thus far: A preliminary survey of right-of-way conditions and subsequent analysis of data usually will permit the engineer to decide upon the selection of anodes or rectifiers for maintaining cathodic protection most economically.

Reasons Supporting Recommended Approach

One of a combination of several of the above-listed right-of-way contingencies dominates the selection of anodes or rectifiers for providing cathodic protection most economically.

The first consideration is that the cost of installing and maintaining cathodic protection with the use of anodes or rectifiers is small in comparison with the investment in the pipeline. Also, the cost of installing and maintaining cathodic protection with the use of anodes or rectifiers is small in comparison with the damage costs that might result from the improper selection of either fixture.

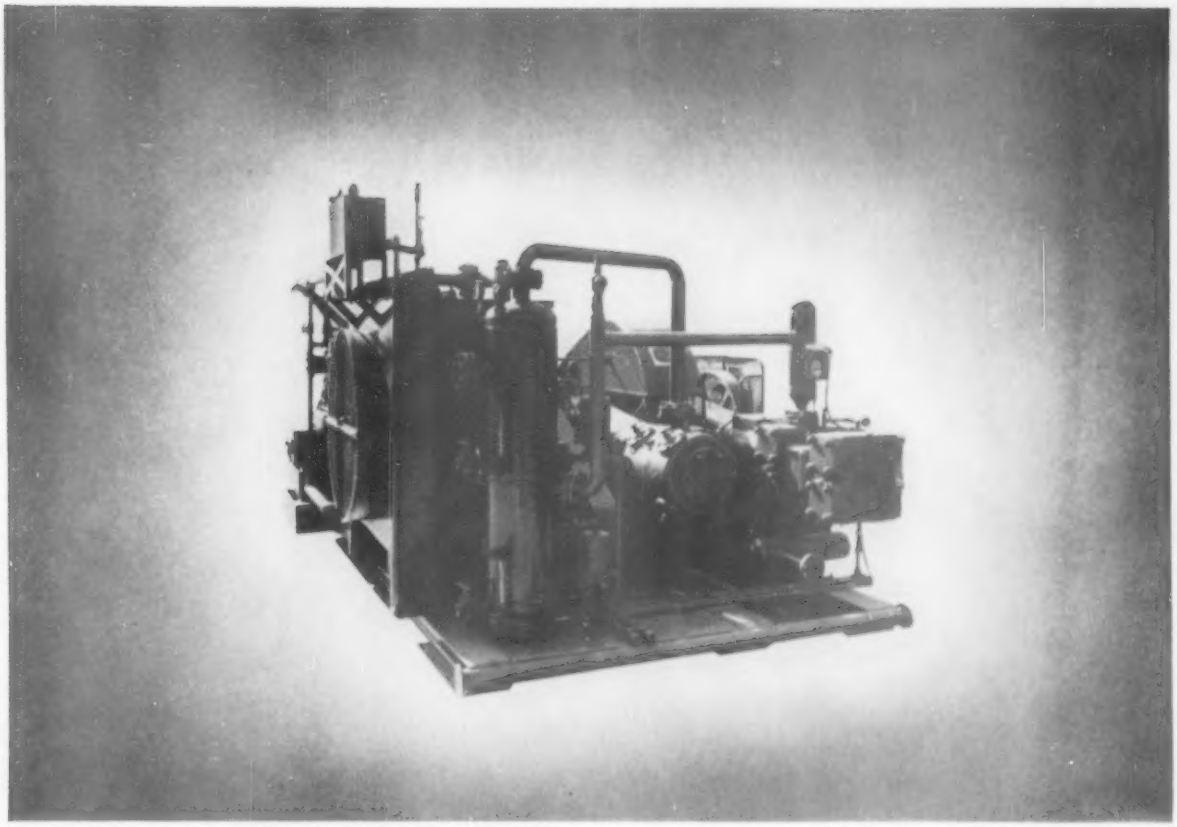
So it is understandable why the presence of even one important right-of-way contingency can decidedly effect the economic cost balance between the use of rectifiers and anodes. Comparatively speaking, the over-all cost of long-term cathodic protection is about the same for rectifiers or anodes—right-of-way conditions permitting. Operating and maintenance cost of rectifiers is, to a great extent, offset by the higher costs that are involved in the more detailed surveys that usually are required for expendable anodes.

In the majority of cases where objectionable right-of-way obstacles do not prevail, it actually would be very difficult to determine an accurate difference in the over-all costs of cathodic protection by the two fixtures without costly detailed corrosion surveys.

Conclusions

The recommended approach to selecting the most economical device for long-term cathodic protection involves primarily the consideration of present and future right-of-way conditions—rather than the conventional procedure of estimating comparative costs.

This is true because the cost of cathodic protection by either anodes or rectifiers is small in comparison to that of the pipeline under consideration and because of the damages that might result from the improper use of either device.



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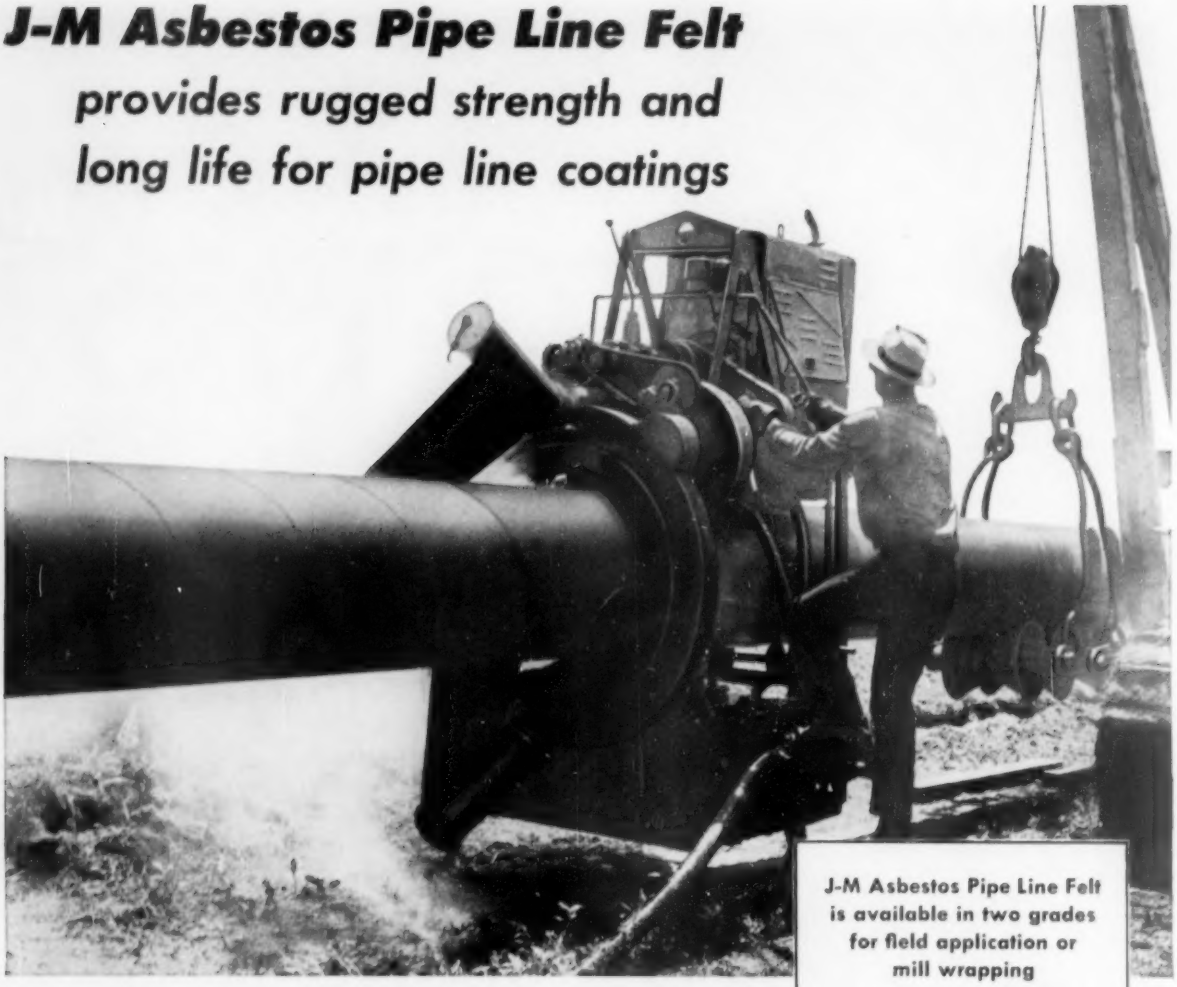

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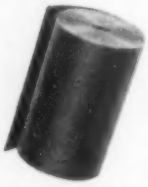

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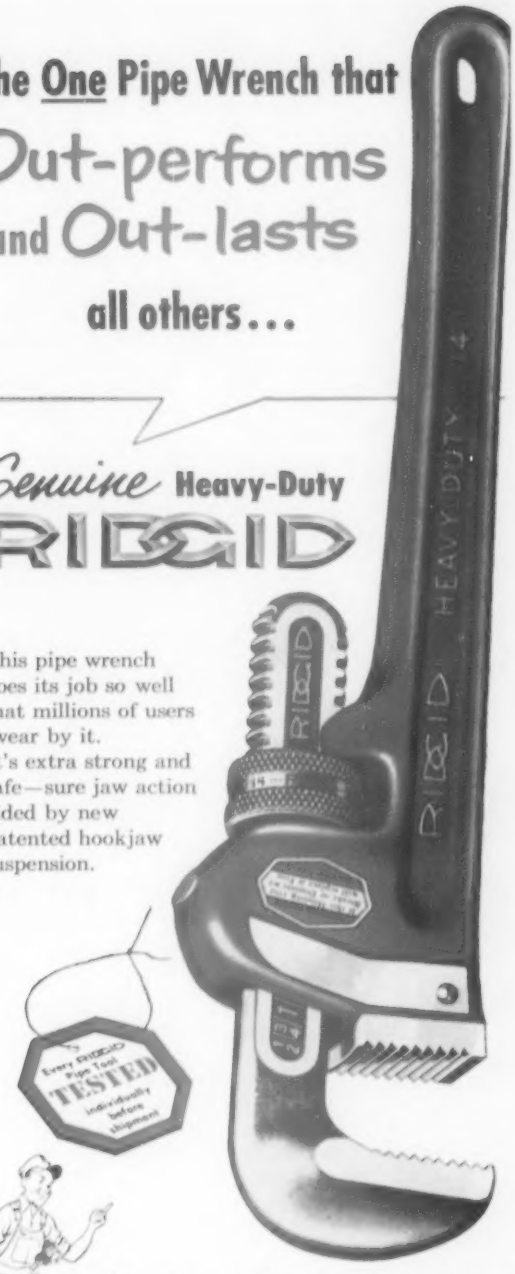

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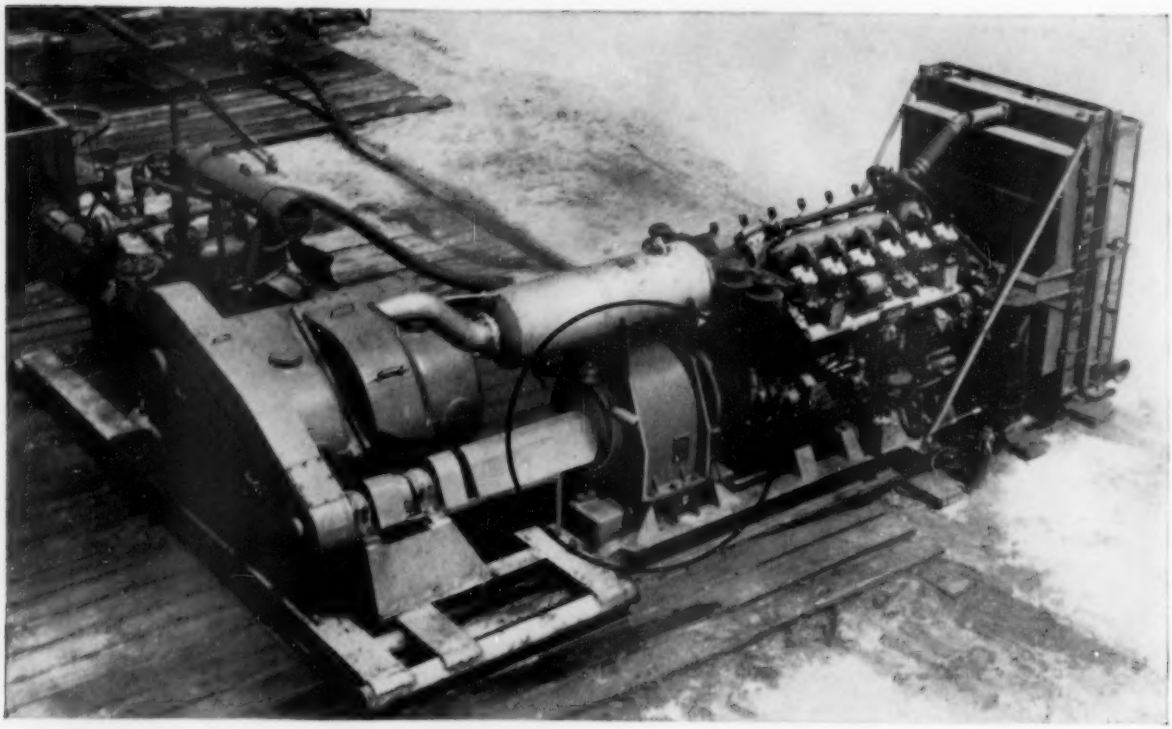

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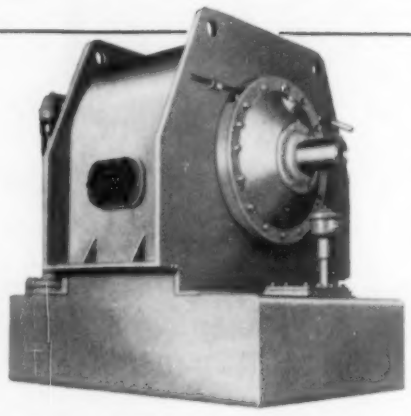

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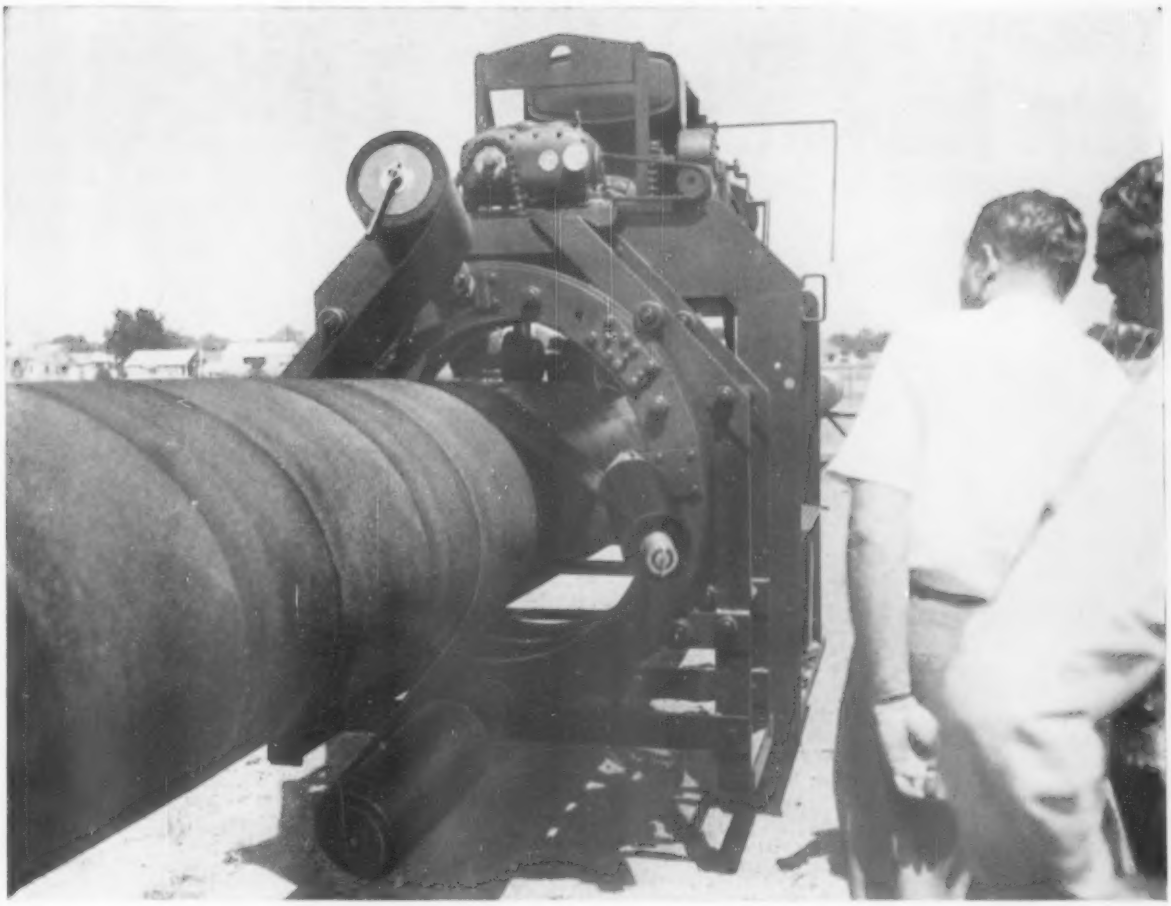

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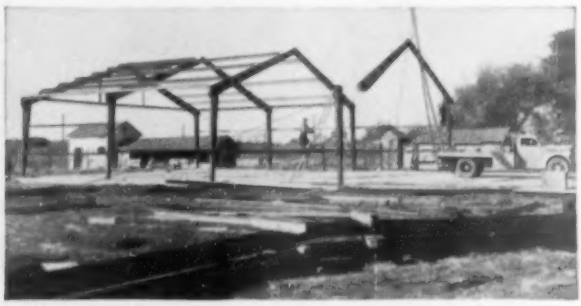

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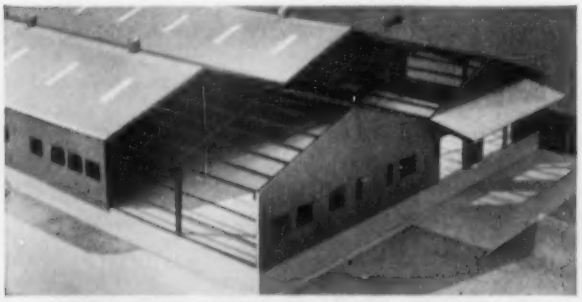

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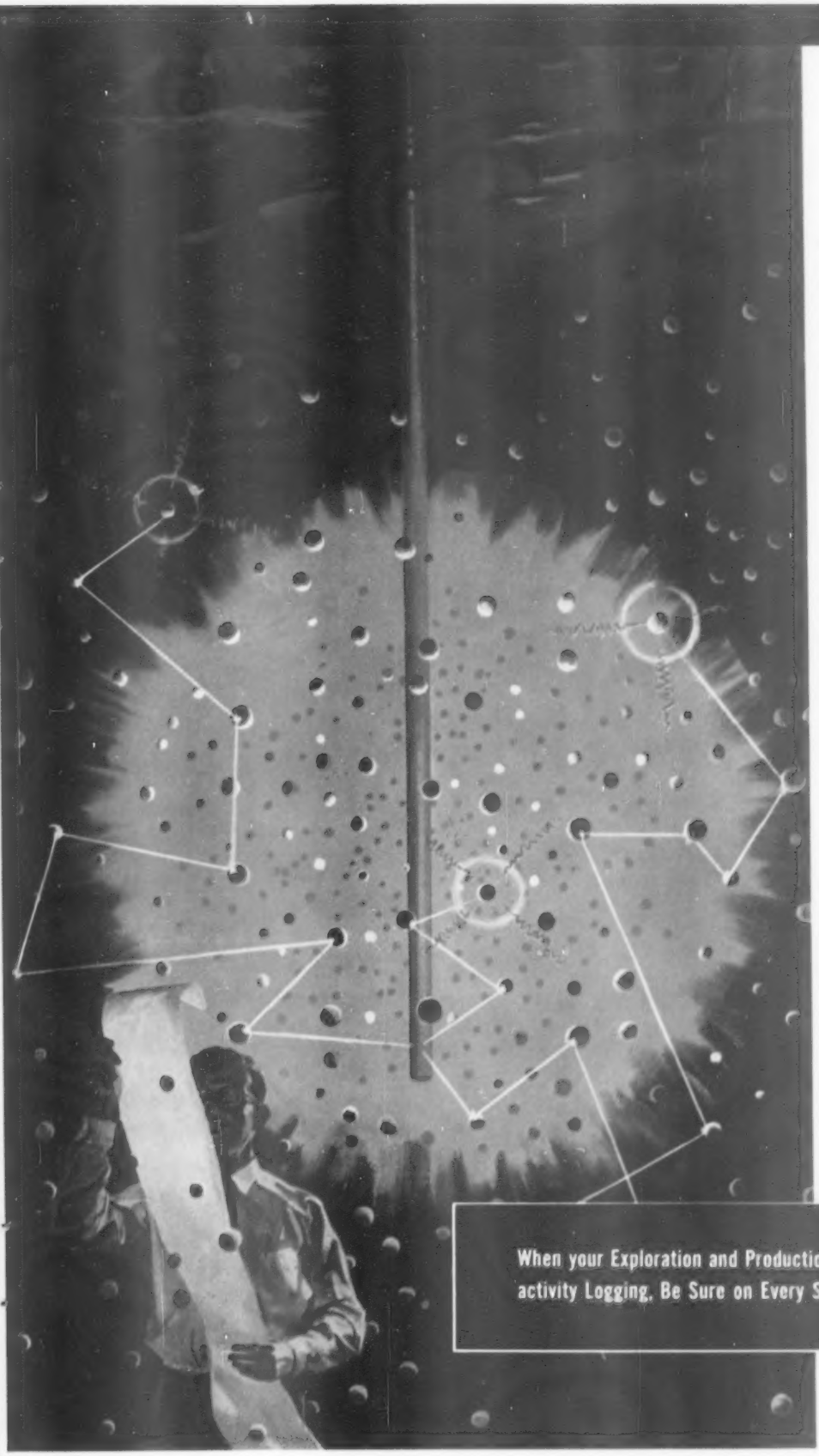

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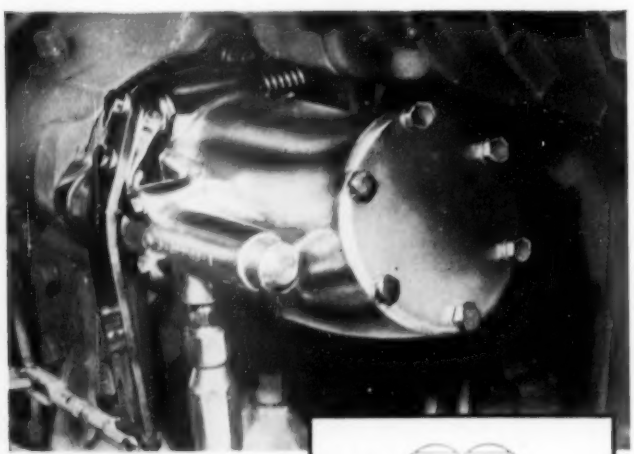
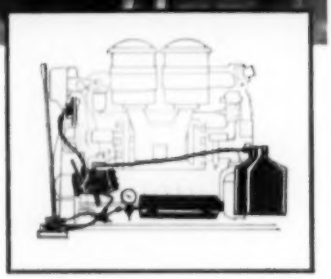


Heart of the Hydrostarter is this hydraulic starting motor. Other components are an engine-driven pump, accumulator, emergency hand pump and reservoir.



15/100 of a second. That's the split-second it takes a Hydrostarter to start a General Motors Detroit Diesel. And a Hydrostarter cuts your operating costs—costs less to maintain even than regular starting systems. In a recent 26-day test one Hydrostarter started a GM Detroit Diesel 26,788 times. For sure, fast starts even at 20° below zero, specify a Hydrostarter on your next GM Detroit Diesel—or have one installed on your present engine. For more information call your GM Detroit Diesel distributor, dealer or write direct.

DETROIT DIESEL

Engine Division of General Motors • Detroit 28, Michigan

Single Engines . . . 50 to 300 H.P. Multiple Units . . . Up to 893 H.P.

AMERICA'S LARGEST BUILDER OF DIESEL ENGINES

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MATERIAL FOR USE WITH LOW GRAVITY CRUDE OR FUEL OILS TO PRODUCE AN OIL BASE MUD
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ECONOMAGIC and PEPTOMAGIC are concentrated oil base drilling fluid materials and are especially suited for overseas operations or wherever transportation costs are high. For the most profitable use of these products consult your OBI representative.

for *FASTER* completions

PEPTOMAGIC

MIXED WITH CRUDE OIL

Prevents water blocking and mudding off producing zone. Deposits a thin mud cake that dissolves in crude oil. Weight materials held in suspension by "peptization." Works well at high temperatures.

PEPTOMAGIC is mixed with a low-gravity (16° to 30°) asphaltic-type crude oil (or fuel oil) and is used primarily for completing wells. It drills a hole to gauge, thereby eliminating one of the most frequent causes of stuck pipe. Any water picked up during drilling is emulsified. PEPTOMAGIC eliminates costly clean-up operations and gets the well on production faster. 10 pounds per barrel of crude oil is adequate.

for *ECONOMICAL* workovers

ECONOMAGIC

MIXED WITH CRUDE OIL

A low-cost, low-weight oil base mud material that is mixed with crude oil. Particularly recommended for wells requiring a minimum weight oil base mud with maximum plastering properties. Deposits a paper-thin special type mud cake that gives maximum protection to the producing formation and tends to prevent lost circulation. Under normal temperatures, does not lose water with the filtrate.

ECONOMAGIC is mixed with a low gravity (16° to 30°) asphaltic-type crude oil (or fuel oil). Ten pounds of ECONOMAGIC per barrel of crude oil is suitable for an excellent light weight mud. ECONOMAGIC is unaffected by salt, cement, anhydrite, etc. ECONOMAGIC is the economical, effective way to reduce lost circulation where plastering is the chief problem. It is *not* recommended where hole temperatures are high nor under circumstances requiring excellent weight material suspension ability.

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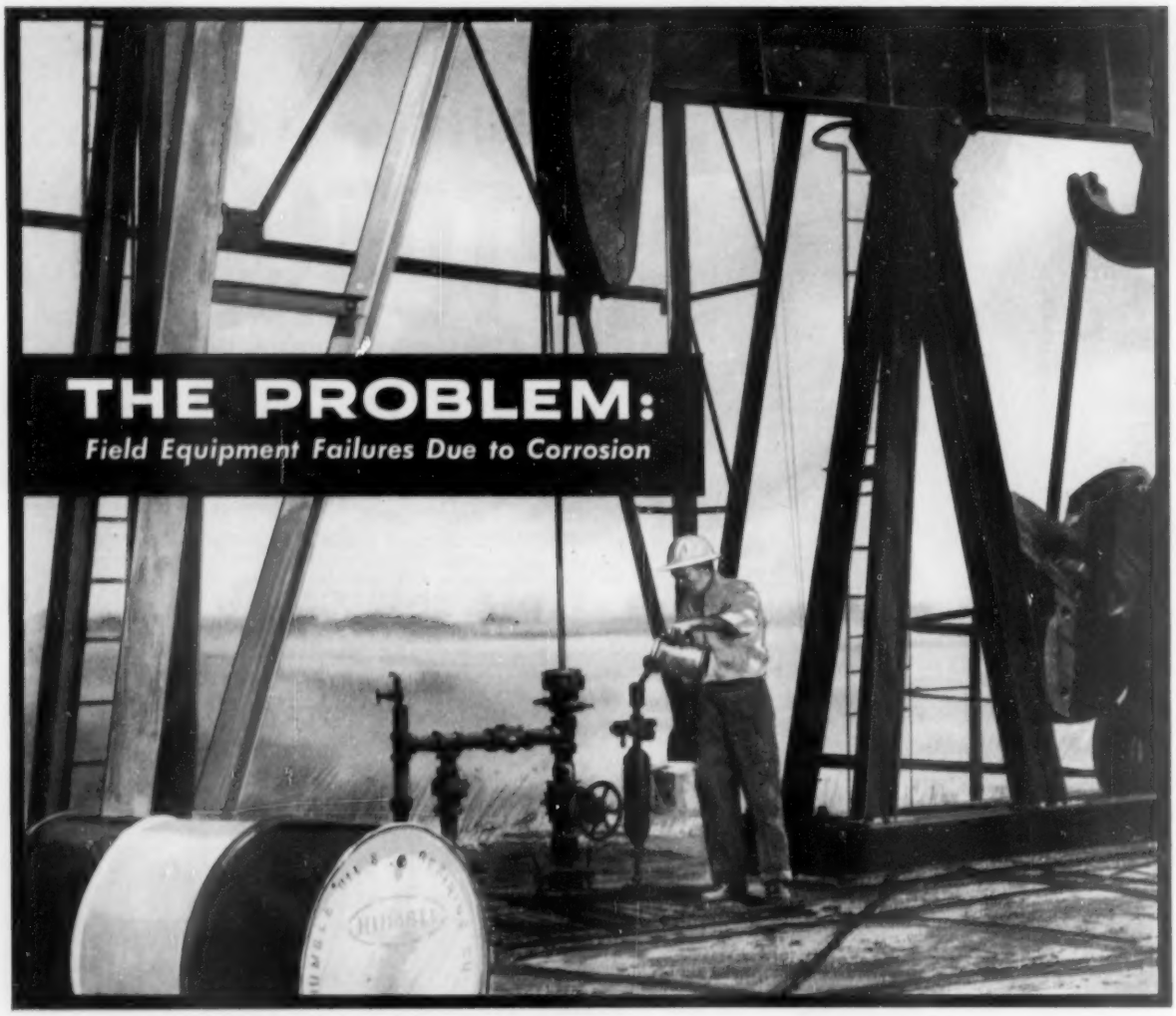


THE SOLUTION: *Humble's* COREXIT—

a Proven Corrosion Preventive

Corexit treatments give sucker rods and tubing positive protection against corrosion and hydrogen embrittlement, even in sour crude wells. *Corexit* cleans your sub-surface equipment, loosens scale and displaces moisture on the metal surfaces. Then it builds up a tenacious and lasting protective film on these clean metal surfaces to prevent further corrosion.

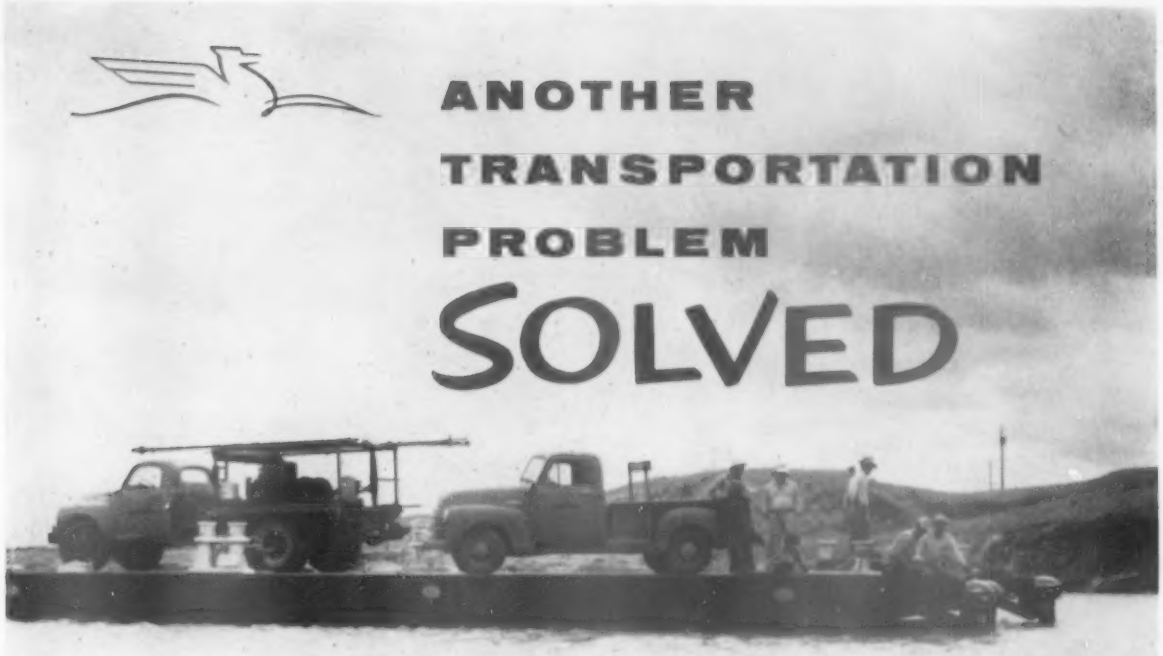
You will find lifting costs lower when you use *Corexit* because fewer well pulling jobs are necessary, and the life of your equipment is prolonged.

For complete information on *Corexit*, see your nearest Humble wholesale plant in Texas and New Mexico, or write or phone: Technical Service, Sales Department, Humble Oil & Refining Company, P. O. Box 2180, Houston 1, Texas.

HUMBLE

HUMBLE OIL & REFINING COMPANY

ANOTHER TRANSPORTATION PROBLEM SOLVED BY JOHNSON SEA-HORSES



NEW SEA-HORSE 30

Here is a 70 ft., 110,000 lb. barge, powered by four DEPENDable 25 hp Johnson Sea-Horses mounted on special outriggers. This barge can carry 100,000 lbs. It draws only 36 inches of water, loaded. It turns in its own length!

Wherever men use boats, you'll see such ingenious application of Sea-Horse power. For this power is versatile!

For 1956 there are *nine* models. A size for every need, from 3 to 30 horsepower. Featuring *new* easier, smoother starting—*new* Stall-Proof Idling—amazing *new* fuel economy—and more!

See your Johnson Dealer. Look for his name under "Outboard Motors" in your classified phone book.

FREE. New 1956 Sea-Horse catalog. Complete. Factual. Helpful. Write!

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A DIVISION OF OUTBOARD, MARINE & MANUFACTURING COMPANY
In Canada: Manufactured by Johnson Motors, Peterborough

9 MODELS FOR 1956

*JAVELIN	30 hp	$582.00
*SEA-HORSE 30	30 hp	552.00
SEA-HORSE 30	30 hp	462.00
*SEA-HORSE 15	15 hp	452.00
SEA-HORSE 15	15 hp	362.00
SEA-HORSE 10	10 hp	321.00
SEA-HORSE 7½	7½ hp	241.00
SEA-HORSE 5½	5½ hp	216.00
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**Electric Starting . . . Prices f.o.b. factory, subject to change . . . OBC certified brake hp at 4000 rpm (30's at 4500 rpm).*

Johnson
SEA-HORSES
FOR DEPENDABILITY

ALL JOHNSON SEA-HORSES ARE PROTECTED AGAINST SALT WATER CORROSION—NO FLUSHING NECESSARY

here's what they mean when they say—

"She's LeBus Spooled!"

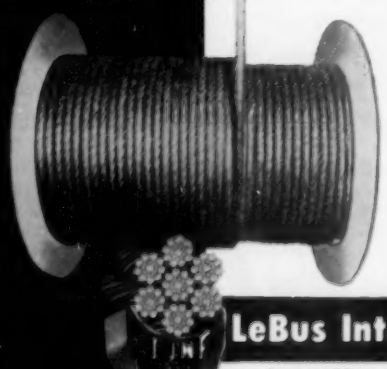
She's LeBus Spooled" is a common expression these days around the oil patch for LEBUS GROOVING AND COUNTERBALANCED WIRE LINE SPOOLING SYSTEMS.

Fully patented, the LEBUS SPOOLING SYSTEMS are now used on over 2500 rigs. Savings of over 18 million dollars yearly are being enjoyed in wire line and drilling time alone!

The LEBUS NEW COUNTERBALANCED SYSTEM is the latest advancement—further reducing the whipping action of the line . . . adding more to its life . . . and allows the line to be spooled at even faster speeds than ever before possible.

LEBUS GROOVING & COUNTERBALANCED SPOOLING SYSTEMS . . .

- Allow faster speed for operation of drilling hoists.
- Allow up to 40% deeper drilling with your present rig.
- Are saving over *$600 per rig monthly in wire line and operating time alone (*Average based on records of 2,500 rigs.)
- Eliminate drum and drawworks vibration formerly caused by bad spooling.
- Eliminate wire line whip between drum and crown.
- Insure greater safety to crew.
- Eliminate hand spooling of line.



Get all the facts — contact a LeBus representative or LeBus direct — NOW.

LEBUS SPOOLING USED ON LLANO OFFSHORE RIG, TOO

We are proud that the Llano Drilling Company specified LeBus Spooling for this important offshore job. Offshore or inland, LeBus Spooling is becoming standard practice with Drilling Contractors today.

Patent Nos.: Counterbalanced Spooling, Nos. 2,734,695, 2,732,150. Controlled Parallel and Helical Spooling, Nos. 2,708,080, 2,620,996. Appli. of grooving, Nos. 2,599,926, 2,204,938. Removable End Fillers, No. 2,216,819. Other patents pending.

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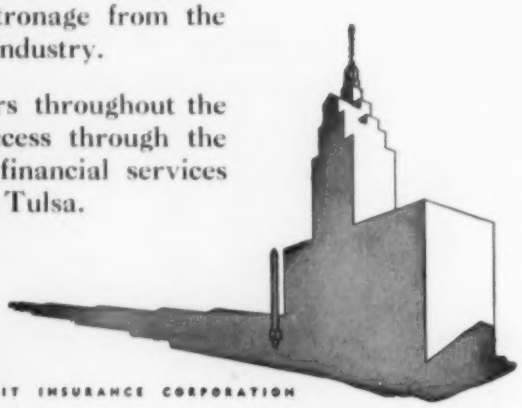
Thousands of oil operators throughout the United States have found success through the experience, "know how" and financial services available at National Bank of Tulsa.



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TRANSFORMERS...THE CHOICE OF LEADERS IN INDUSTRY

Where uninterrupted power is a must...

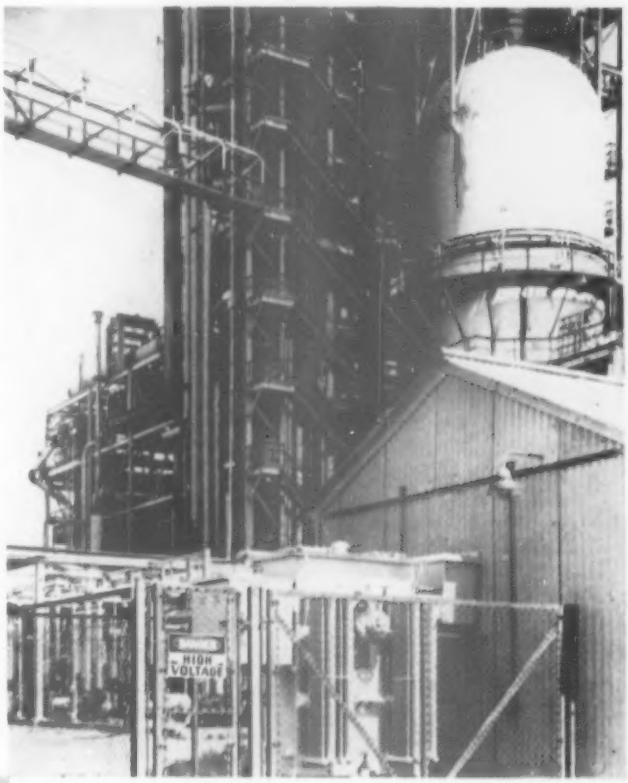
WAGNER UNIT SUBSTATION TRANSFORMERS

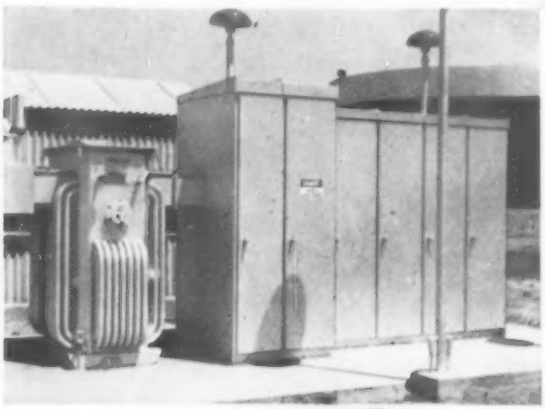
A completely dependable power supply is a vital necessity to an oil refinery. A power interruption of only a few minutes on a "cat cracker," like the one shown at the right, would completely disrupt this important processing operation and cause a shut-down of the entire refinery.

That's why you'll find Wagner Unit Substation Transformers at work at the Carter Oil Company refinery at Billings, Montana.

Wagner transformers are often found in installations where power supply failure would incur great loss because they have a reputation for complete dependability—backed by sixty-five years of transformer building experience.

Wagner Unit Substation Transformers, both liquid-filled and dry-type, are carefully designed to meet distribution requirements. Both liquid-filled and dry-type unit substation transformers are built in ratings through 2000 kva, 15 kv and below—you can choose the type and rating that exactly meets your load-center distribution requirements. Call the nearest of our 32 branch offices, or write us.





The 750 kva, 2400/4160Y to 480 volt, 60 cycle, three-phase, liquid-filled Wagner Unit Substation Transformer feeds the catalytic unit at The Carter Oil Company refinery. At left is shown a 225 kva Wagner substation transformer connected to an outdoor substation at the same refinery. Purchased and installed by The Fluor Corporation, Ltd., Engineers and Constructors for the Petroleum, Chemical and Power Industries, Los Angeles.

* * *

Write for Bulletins TU-205 and TU-214. They give full information on Wagner Unit Substation Transformers. Consult the nearest of our 32 branch offices about your next transformer installation.

Wagner Electric Corporation
EST. 1891

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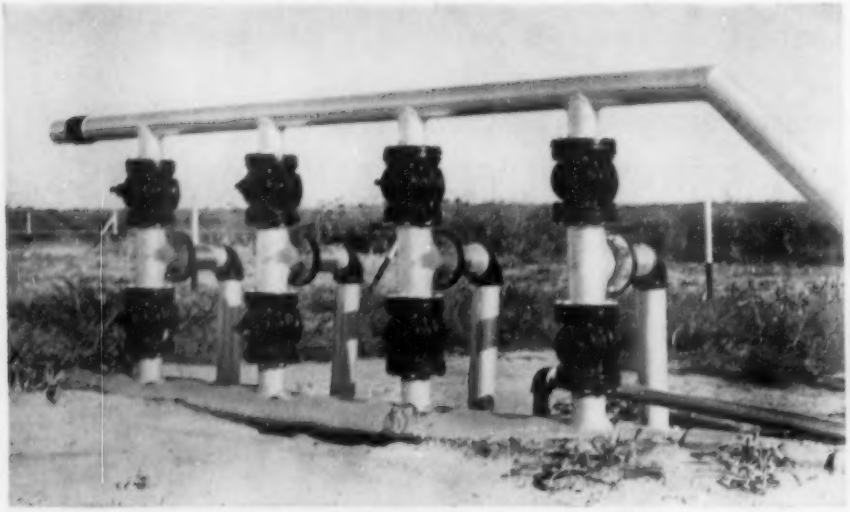
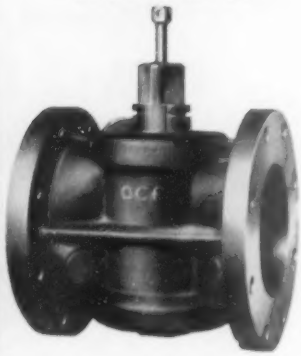


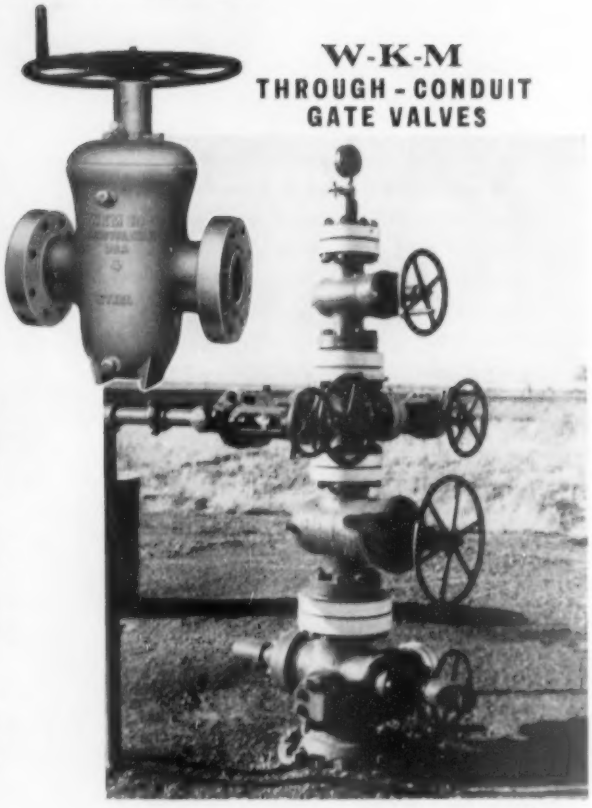
QCf LUBRICATED PLUG VALVES



NOW-

Both High and Low Pressure Valves from W-K-M

W-K-M THROUGH-CONDUIT GATE VALVES



For your Christmas Trees, flow lines, and wherever else high pressures must be safely and positively controlled, there are the famous W-K-M- through-conduit gate valves, in working pressures from 1,000 to 15,000 pounds.

QCf lubricated plug valves, of steel, semi-steel, and special metals, with round or rectangular ports, in working pressures from 200 to 500 pounds—are the perfect companion valves for gathering lines, manifolds, headers, and similar low pressure installations.

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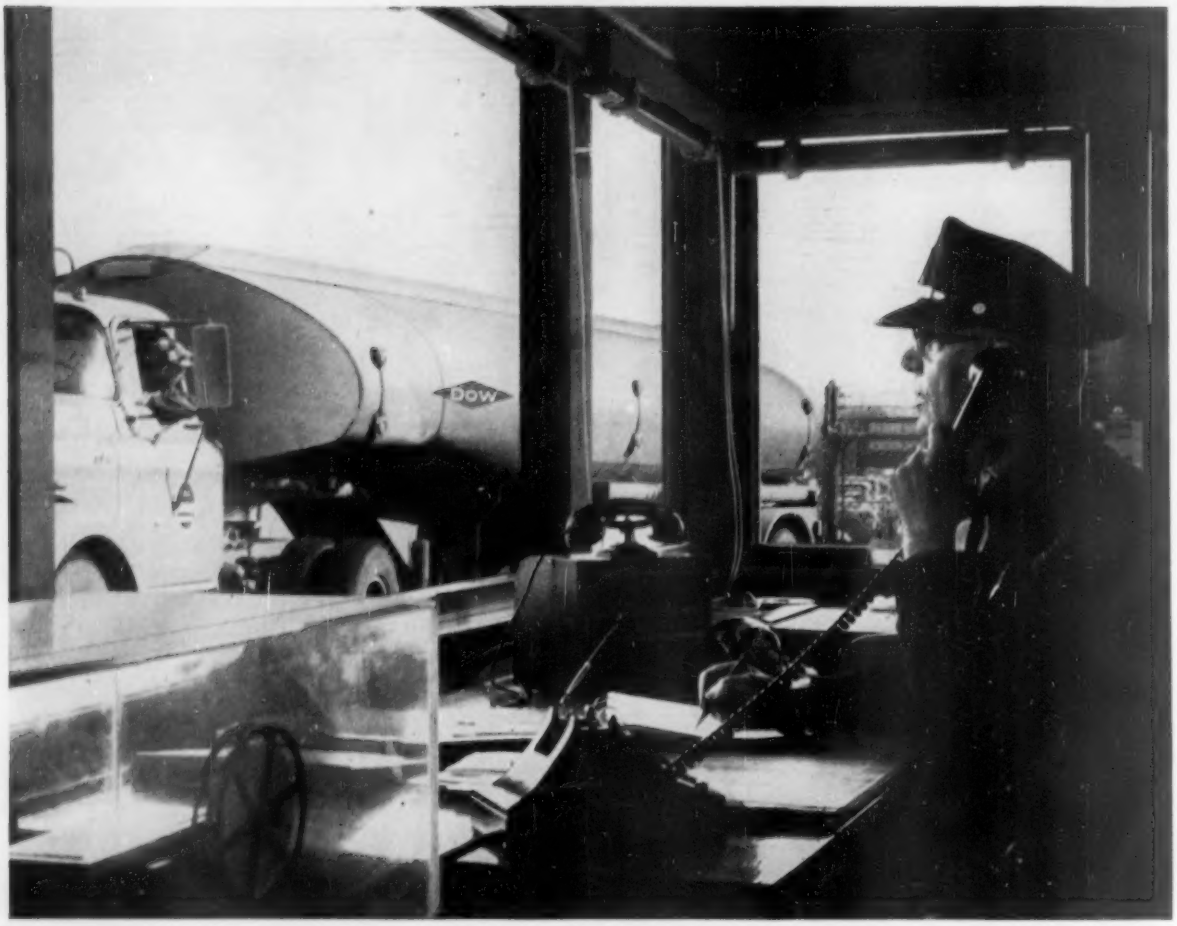

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Dow shipments will arrive on time—when you need them. You can depend on it.

Whether you need *Diethylene Glycol* or *Triethylene Glycol* for dehydrating or *Monoethanolamine* and *Diethanolamine* for sweetening natural gas, you can rely on Dow. For service, availability and prompt delivery contact your nearest Dow sales office or THE DOW CHEMICAL COMPANY, Midland, Michigan, Department OC-847E-1.

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Use SpringKore flexibility and crush resistance to cut your rotary drilling line costs

J&L SpringKore Rotary Drilling Lines are designed with a tightly coiled, high quality steel spring center that replaces independent wire rope or hemp fiber core. The SpringKore center gives rotary drillers a wire rope with unusually high resistance to crushing action *plus* extreme flexibility.

Check these SpringKore features and see why J&L SpringKore gives you longer service life on your rotary rigs.

LONG-TERM FLEXIBILITY
SpringKore's highly flexible center and wide distribution of internal pressures maintains original rope flexibility under long periods of heavy-duty service.

RESISTS CRUSHING ACTION
Coiled steel spring center has great resistance to crushing . . . snaps rope back to its original shape and diameter.

COMPLETE LUBRICATION
SpringKore's hollow center acts as a lubricant reservoir . . . reduces corrosion and friction wear by assuring lubrication of innermost parts of rope.

MORE SUPPORTING CONTACT POINTS
The coiled shape of the spring center gives the strands of the rope more supporting points . . . reduces friction by spreading pressure evenly over many contact points.

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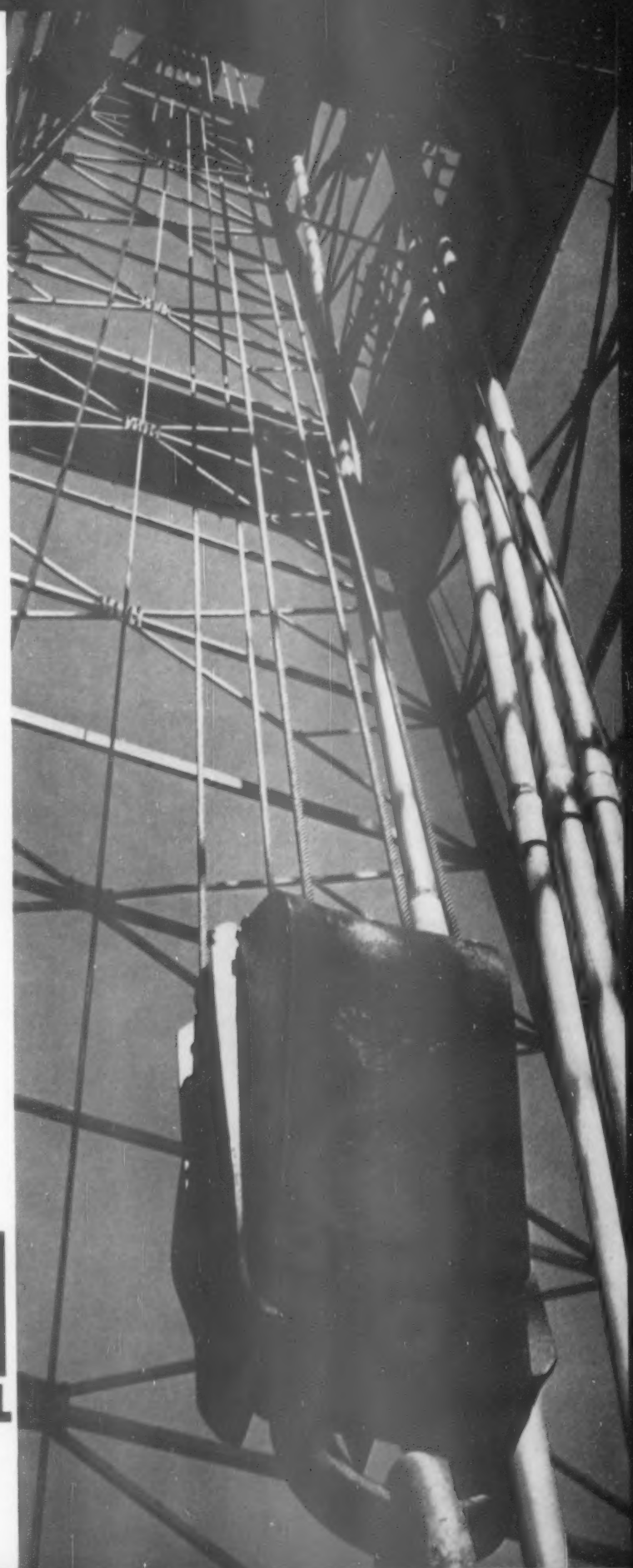
The firm internal support provided by the spring center maintains uniform rope diameter . . . reduces wear caused by outer strands rubbing against each other.

LESS INSIDE STRAND WEAR
The spring center flexes under crushing instead of scoring strands . . . reduces wear on inside wires.

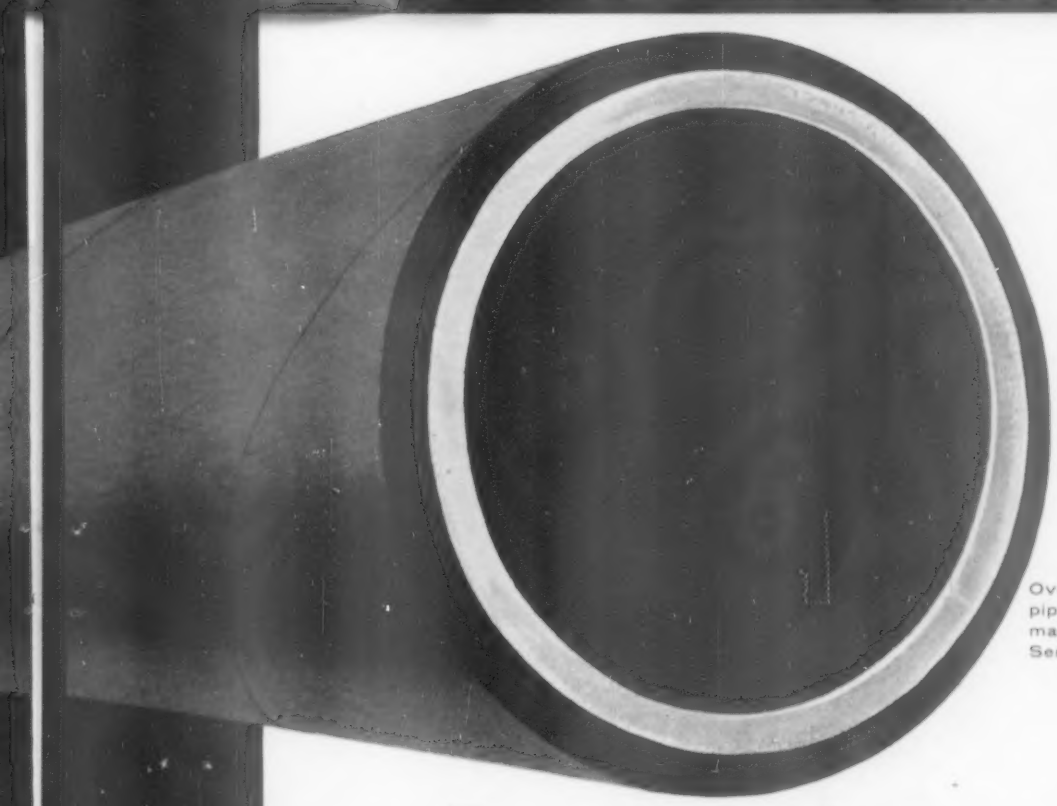
Put these SpringKore advantages to work on your rotary drilling rigs. Specify J&L SpringKore Rotary Drilling Lines. Available in standard sizes and construction.

J&L STEEL

Jones & Laughlin
STEEL CORPORATION · PITTSBURGH



There's a PLS plant strategically located to serve YOU!



Over 100,000 miles of protected pipe in 25 years . . . that's the unmatched experience of Pipe Line Service!

Experience that's measured in ***thousands of miles!***

Everywhere in the industries we serve, the value of *uniform* pipe protection is becoming more and more widely recognized. The difference between uniform protection and hit-or-miss field work can often mean the difference between future profit and loss.

And so the *experience* of the company that coats and wraps pipe . . . the ability to stick to high standards of uniformity . . . are factors that are being given an extra-careful look. After all, valves, pumps and other components are always accessible for inspection or replacement. But, once pipe is buried, there's only one inspection possible—*the inspection of time!*

That's why Pipe Line Service makes no compromise with the quality of protection that results from *controlled* production—under roof and independent of the weather. That's why we've always pioneered in new processes . . . better machinery . . . closer inspection. For the finest in pipe protection—and for the maximum return on your investment—call in your nearest PLS representative!

Pipe Line Service Corporation

FRANKLIN PARK, ILLINOIS

Quality pioneers in coating and wrapping pipe for a quarter century

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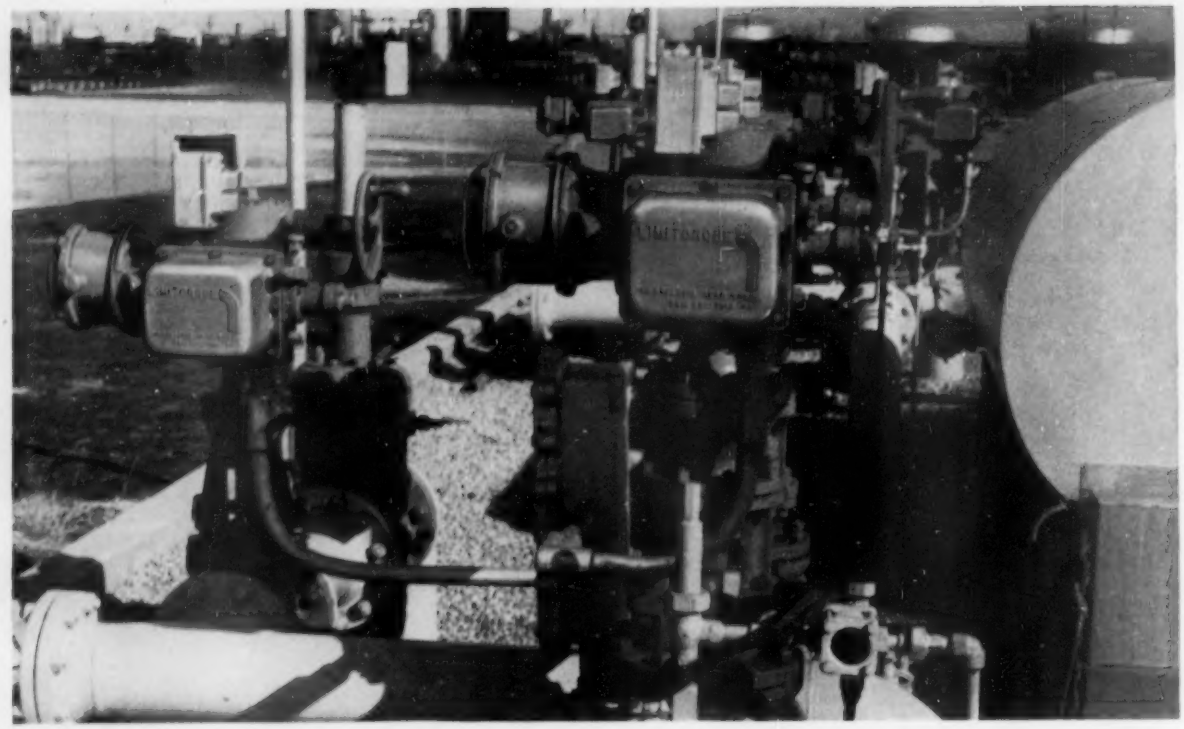
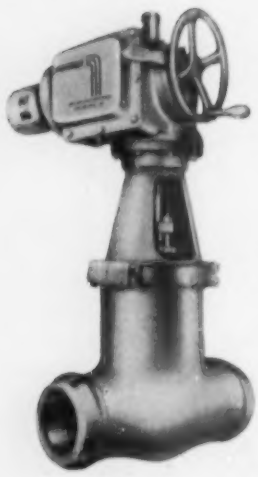


Many types and sizes of Valves at Cherokee's modern Conoco Refinery, are "push button" operated by LimiTorque



Plug valves and gate valves, in abundance—are electrically opened and closed by LimiTorque controls in the Ponca City, Oklahoma Refinery of the Cherokee Pipe Line Co., Products Division—on suction and discharge lines to main pumps, and on receiving lines from the refinery . . . From central control panels, the exact status of each valve is readily ascertained —opening, closing or stopping at the will of the operator.

LimiTorque provides simplicity, safety, economy and real dependability under all climatic conditions—and it is noteworthy that more LimiTorque controls are in use in Refineries and Pipe Lines than all others combined.

Send for new catalog L-550, and please use your Business Letterhead when requesting.

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SECURITY QUALITY SHOWS...
after drilling two miles in Arbuckle lime!

Drilling for Frankfort Oil Company near Ardmore, Oklahoma, Riceland Corporation opened 11,616 feet of hole in solid Arbuckle lime — a record depth in this hard rock formation. After comparing performance of the two biggest selling brands of rock bits used exclusively on this location, Riceland Toolpusher Page Arnall said:

"When bits were pulled, Security dulls looked better. Cones and bearings stood up better under this hard drilling — more insurance against fishing jobs."

To look better after coming out of the hole means this: Security bits *were* better before going into the hole. Better engineered . . . better designed . . . better built. Results on this, and hundreds of other locations, prove it! Here, each Security bit averaged four feet of hole more than competitive bits used — 53.7 feet compared with 49.7 feet.

Constantly alert for ways to cut costs, progressive contractors everywhere are switching to Security. Try Security rock bits on *your* next location. Prove to yourself that drilling costs drop when you *get Security in your drilling!*

Security
ENGINEERING DIVISION

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Write for 1956-1957 Catalog.

ROCK BITS • REAMERS • CASING SCRAPERS • RUBBER STABILIZERS

MASTER-CRAFTED BY

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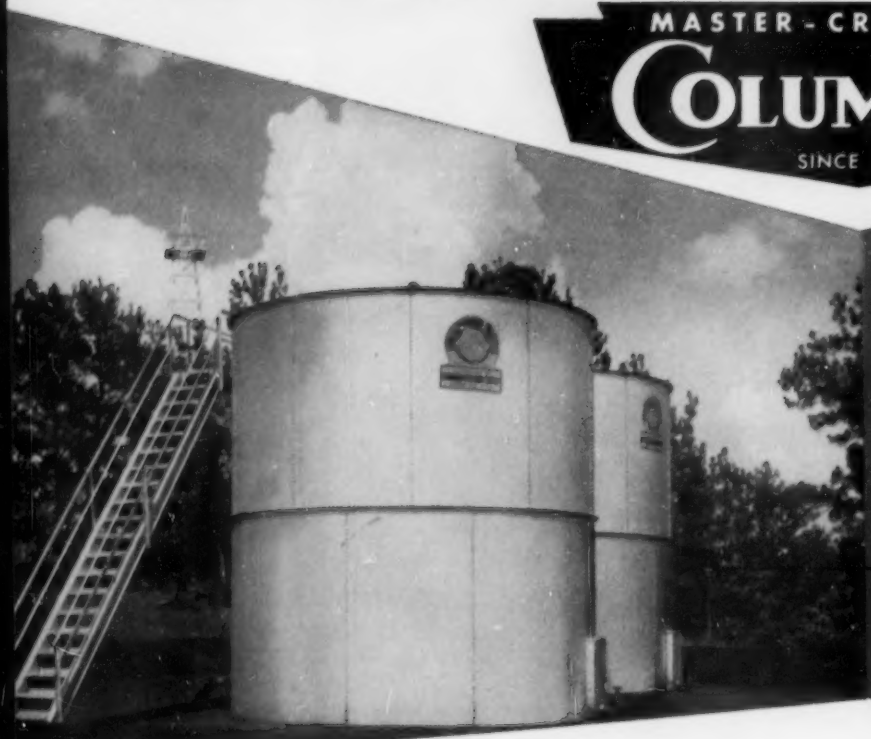

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Trade Mark Reg. U. S. Pat. Off.

precision engineered

Columbian Bolted Steel Tanks

From the first hours saved in erection time to the decades of lasting service there's no more profitable oil storage than Columbian Bolted Steel Tanks. The precision engineered, formed and punched plates and decks go up faster, fit tighter, last longer. More than 61 years of experience in fabricating steel is behind the master craftsmanship built into every Columbian Tank, to give it lasting strength. After years of service, a Columbian tank can be quickly taken down and re-erected at a new location, without loss of quality. Whatever tank size you need, wherever you want to locate it, you can depend on Columbian for fast delivery and high quality.

IN THE FIELD OR AT THE PLANT, you can't do better than a rigid, strong, fire-safe Columbian Metal Building — for pumphouse, storage, warehouse, garage or equipment. Easily, quickly erected with accurately fitting sectional panels. Write for Free catalog and complete details.

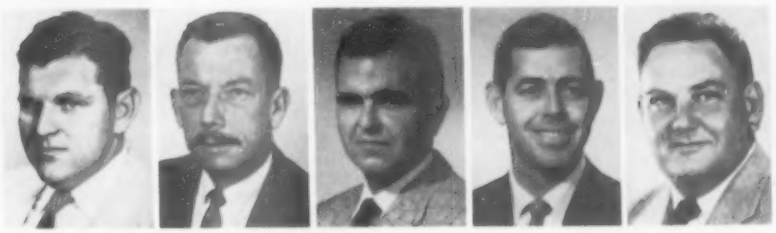
COLUMBIAN Steel Tank Co. P. O. BOX 4048-J, Kansas City, Mo.

STEEL, Master-Crafted by Columbian... First for Lasting Strength

EQUIPMENT MEN . . . in the News

J. H. Beasley | B. L. Boccella | W. C. Kellogg | W. A. Henslee | H. C. Loehr, Jr.

H. I. Bussa | P. A. Newton | C. D. Allen, Jr. | E. L. Easley | J. H. Dunaway



H. C. Leland | C. A. Reid | O. L. Riley, Jr. | O. A. Hicks | L. T. Downs

Kellogg Adds Bratton And Clarke to Its Staff

W. E. BRATTON

R. L. CLARKE

W. E. Bratton and Ralph L. Clarke will represent The M. W. Kellogg Co. in administration and handling of engineering and construction contracts in the petroleum and petrochemical fields, according to R. J. Wolf, vice president of the company.

Bratton was formerly head of the contract department of The Lummus Co. Clarke, a petroleum engineer, was formerly with Badger Process Division of Stone & Webster Engineering Corp. He has had design and operating experience in the petroleum-refining, petrochemical, and natural-gasoline industries in Oklahoma and the Texas Gulf Coast.

Failing Appoints Johndrow As Sales Vice President.

E. A. JOHNDROW

The appointment of Edward A. Johndrow, Jr., as vice president in charge of sales for George E. Failing Co. of Enid, manufacturers of portable drilling rigs, has been announced by Robert M. Greer, chief executive officer of the company. Johndrow is assuming the position left vacant by the recent resignation of J. T. Tucker.

Johndrow has been associated in various capacities with the Failing company since 1946. He has served since 1953 as treasurer. He also is a director of George E. Failing Supply Co., Ltd., of Edmonton, Canada, wholly owned subsidiary of the Failing company of Enid.

Baroid Changes in Drilling-Mud Department

Sixteen important promotions and transfers, within the drilling-mud department of Baroid Division, National Lead Co., have been announced by Amos A. Roberts, manager of the department.

Jack H. Beesley, former manager of Baroid's Mid-Continent area with headquarters in Tulsa, has been appointed sales manager of the drilling-mud department and will headquarter in the company's main offices at Houston. B. L. Boccella has been appointed manager, Mid-Continent area, to replace Beesley. Boccella was assistant Mid-Continent area manager prior to this change.

W. C. Kellogg has been named assistant area manager of the Louisiana Gulf Coast area with headquarters in New Orleans. He will supervise the area's district superintendents and their respective personnel. Kellogg was superintendent of the South Texas Corpus Christi district with headquarters in Corpus Christi and is replaced by W. A. Henslee, formerly superintendent of West Texas Odessa district.

Harry C. Loehr, Jr., has been appointed assistant manager of the Mid-Continent area with offices in Tulsa. He was formerly Louisiana Gulf Coast area sales manager.

New Texas Gulf Coast assistant area manager, with headquarters in Houston, is H. I. Bussa, former superintendent of the northern Oklahoma district with headquarters in Oklahoma City.

A new sales office in Lafayette, La., will be headed by P. A. Newton who has been named Louisiana Gulf Coast area sales representative. He was formerly superintendent of the Lafayette district.

A new assignment as superintendent of the New Orleans district has been given F. M. Hill, Jr., former New Orleans district sales representative. His headquarters will be in New Orleans.

C. D. Allen, Jr., will take over the duties as superintendent of West Texas, Odessa district, turning over the North Texas Sherman district superintendency to Ed L. Easley, who has been promoted from service engineer of the Amarillo and Abilene district. His district headquarters will be in Wichita Falls, Tex. J. H. Dunaway has been appointed superintendent of the Louisiana Lafayette district and will con-

NEW CHEMICALS . . . NEW METALS . . .

NEW MACHINERY . . .

NEW PROCESSES

FIRE-FOG

AIR FOAM

NEW FIRE HAZARDS

"Automatic" SPRAY Sprinkler

At "Automatic" Sprinkler we've kept abreast of technological advancements and the effect of such progress in terms of fire safety for every business. In short, we either have the answer to your fire protection problem or our technicians will get it for you.

HIGH PRESSURE CO_2

LOW PRESSURE CO_2

Send for Bulletin 73 - Engineered SPECIAL HAZARD Fire Protection

DRY CHEMICAL

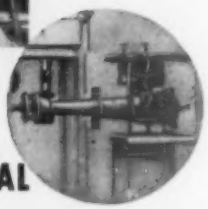
"Automatic" Sprinkler

CORPORATION OF AMERICA

YOUNGSTOWN, OHIO

Offices in Principal Cities of North and South America

VERTICAL



OR

HORIZONTAL

many more hours on stream without forced shutdown with NATIONAL AIROIL

OIL-GAS TANDEM COMBUSTION UNITS

Exclusively for vertical firing, the new National Airoil VERTICAL Tandem Block Units retain all the features of our regular horizontal Tandem Units . . . **plus:** special, precast refractory shapes for easier, cost-saving vertical installation and maintenance; secondary air inlet louvres for positive control of vertical flame pattern; and, all steel duplex detaching gear which enables swift, simple vertical burner changeover.

VERTICAL and HORIZONTAL Tandem Units hold air in the combustion zone until fuel and heated air are thoroughly mixed. This means that ignition takes place in a hot zone; the result: high fuel economy through more rapid combustion with a minimum of excess air. NATIONAL AIROIL's patented Tandem Combustion Units allow secondary air to be easily and accurately controlled. By adjusting air control louvres, flame can be shaped to radiate heat uniformly without tube impingement.

The VERTICAL or HORIZONTAL Tandem Unit is always fired with NATIONAL AIROIL Combination Oil and Gas Burners . . . has a high turndown ratio with a steady flame temperature using either fuel oil or gas. With the TANDEM UNIT's clean flame, a cold furnace can be brought to full capacity in a short time.

"Many, many more hours on stream, without shutdown" . . . yes, YOU will realize higher profits from YOUR heaters when NATIONAL AIROIL VERTICAL or HORIZONTAL Tandem Units are specified. Our new Bulletin 498 is yours for the asking.

CHEMICAL-PETROLEUM DIVISION

NATIONAL AIROIL BURNER CO., INC.

1236 EAST SEDGLEY AVE., PHILA. 34, PA.
Southwestern Division
2512 South Boulevard, Houston 6, Texas
INDUSTRIAL OIL BURNERS, GAS BURNERS, AND FURNACE EQUIPMENT

tinue to headquarter in New Iberia, where he has been a service engineer.

H. C. Leland, area engineer in Midland, Tex., area office, has been transferred to Dawson Creek, B. C., where he will take over duties as superintendent of the northern British Columbia and northwestern Alberta district. C. A. Reid, Pacific Coast area engineer, will replace Leland as area engineer in the West Texas area, Midland office. O. L. Riley, Jr., has been named Pacific Coast area engineer with headquarters in Los Angeles.

Another change in the Mid-Continent area makes O. A. Hicks superintendent of northern Oklahoma district, with headquarters in Oklahoma City. He was formerly district sales representative in Oklahoma City and those duties will be assumed by L. T. Downs, former sales engineer, in Chickasha, Okla.

Carlon Names Dunn Vice President and Sales Manager

T. W. DUNN

The appointment of T. W. Dunn as vice president and general sales manager of all divisions of Carlon Products Corp., Cleveland, Ohio, has been announced by Brigham Britton, president. Carlon is a producer of plastic pipe and extruded tubular products.

For the past 2 years, Dunn has served Carlon as sales manager. Prior to coming to Carlon, he had been with Atlas Plywood Corp., for 5 years.

Los Angeles Nomads Plan Whing-Ding

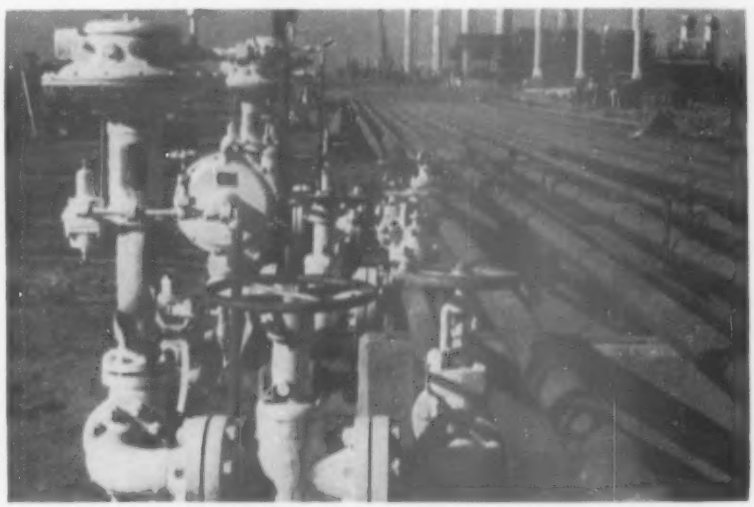
Los Angeles chapter of Nomads is busily preparing for its annual Whing-Ding, to be held this summer on July 13 at Lakewood Country Club. The affair includes a day of golf plus dinner and entertainment.

An unusual feature of the Whing-Ding will be an exhibition by Bill Brooks, nationally known trick-shot golfer, who will use Vern Mitchell's head as a tee. Golf has been planned for all classes of golfers, from duffer to pro, with prizes in all classes.

Following are the men responsible for arrangements: general chairman, William Brooks, Byron Jackson Division; assistant general chairman, Murray Walker, Lane-Wells Co.; golf committee, Chili Sutton, Oil Well Manufacturing Corp., chairman; Knight Templeton, S. R. Bowen Co.; Shorty Bowen, Martin-Decker Corp.; Ben Hil-

Salt Water Circulation System kept free from corrosion by internal plastic coating . . .

"In Place coating operation makes possible continuous coating across welds, fittings and manifolds."



To safeguard equipment against salt water corrosion in an underground propane-butane storage operation in West Texas, in August of 1954 IPM engineers were called in to make recommendations. In this operation, manufactured products stored in a salt dome are displaced by 1.2 gravity brine. Lines range from 4" to 10" in diameter.

IPM internally cleaned and coated all lines, laterals and fittings. Extensions were also cleaned and coated, as added. IPM's services were completed in May of 1955.

Factory-applied coatings would have served no purpose because of the absolute necessity of maintaining continuity of coating across welds.

A casual inspection in January of 1956 indicated that all coatings were giving perfect protection. Coatings were intact and showed no signs of discoloration, softening, deposition or other failure. This inspection was made informally when lines were opened in order to make changes to the system.

Field Fact reports covering solutions to problems of corrosion, throughput, paraffin and other depositions are available without charge, on request.

Internal Pipeline Maintenance Co.

2105 NORTH JACKSON ODESSA, TEXAS

the company with the longest continuous service experience in its field

liard, Web Wilson Oil Tools; and Vern Mitchell, Security Engineering Division.

The committee in charge of dinner is chairmanned by Ted Drake, Petroluem World, and includes Lee Laird, Cardwell Manufacturing Co. Joe Schlarb, Emsco Manufacturing Co., is in charge of entertainment, and Tom Ashe, Globe Oil Tools Co., is assisting him. Robert Gaylord, Wagner-Morehouse Co., is chairman of the prizes committee, and he is assisted by Murray Walker and Vern Mitchell. Rex Collins, Hydril Co., is keeping a watch over the budget and Don Hanson, The Oil and Gas Journal, is handling publicity.

Axelson Petroleum Sales Representatives Hold Meet

A 3-day conference for petroleum sales representatives was held recently at the Axelson Manufacturing Co., division of U. S. Industries, Inc., home office and plant in Los Angeles. This was one of a series of monthly sales meetings to be held during 1956 under the supervision of E. D. Jackson, Axelson general sales manager, and K. S. Ramey, sales manager of the petroleum-equipment department.

At the meeting sales personnel were shown the latest developments in the metallurgy, manufacture, and testing of plunger-pump parts and hydraulic pumping units. They were given a refresher course on the applications for Axelson pumps, followed by a field trip through Long Beach and Wilmington fields to see Axelson hydraulic units in action.

Williams Heads Newly Formed Pacific Mud Co.

Organization of Pacific Mud Co., a new firm which will distribute oil-well-drilling muds in the West Coast area, has been announced by Fred B. Williams, president. The new company will operate a number of warehouse stock points throughout California. Headquarters have been set up in the National Oil Building, Los Angeles. The company will be distributors for Magnet Cove Barium Corp. of Houston.

F. B. WILLIAMS

K. E. BARLEY

J. R. HOMAN

Principals of the new firm are experienced in the oil-well drilling-mud field. In addition to Williams, officials include Kemp E. Barley and J. R. Homan, vice presidents.

Williams has been active in the drilling-mud business for 17 years. For the past 4 years, he has been a West Coast district engineer for Sunray Oil Co. Barley has been associated with oilfield service for 18 years. He was with Gulf Oil Co. 3 years and with Halliburton Oil Well Cementing Co. in the Mid-Continent area for 2 years. Homan was formerly division sales manager for Magnet Cove Barium Corp. Prior to joining Magcobar, he served as a driller and engineer with Arabian American Oil Co. and as a driller for various drilling contractors in the Mid-Continent area.

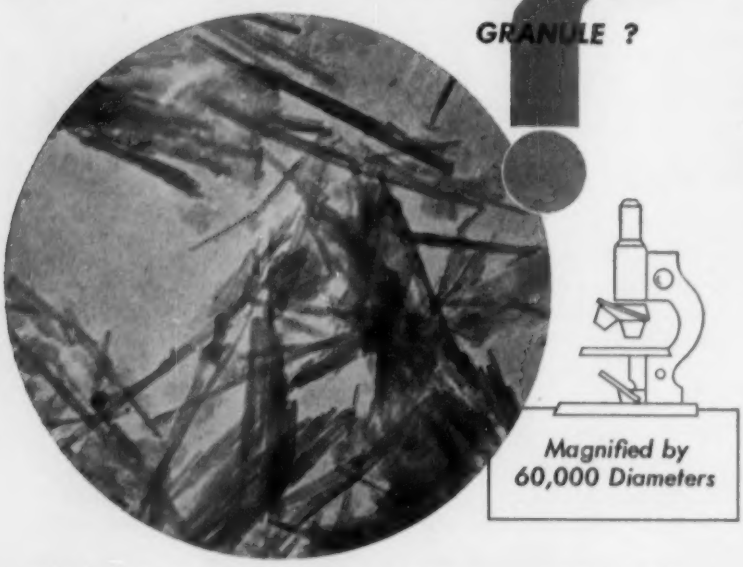
Colton Names Sales Mgr. For Microballoon Spheres

The appointment of Charles J. Vickers as manager of technical sales and service of the Colfoam microballoon spheres department of Colton Chemical Co., a division of Air Reduction Co.,

EVER LOOK INSIDE A

Florex ?

GRANULE ?



Magnified by 60,000 Diameters

The fibrous nature of Florida Fullers Earth, commercially available as Florex, reveals each unit consisting of about 2200 molecules in a bundle, providing ready selectivity in adsorption of color and contamination from organic and inorganic liquids and gases.

Florex quality means specially processed fullers earth giving maximum surface area and adsorption efficiency. Florex is unequalled in high quality or low cost for processes involving the use of highly active clay for sweetening light distillates, dehydration, desulfurization, and polymerization.

Standard meshes from 2/4 to 200/up and our experienced adsorption specialists are available to help you solve complex laboratory or production problems.

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Grip-Tite

POSITIVE EXPANDING ANCHORS
"Dead Men That Hold"

Anchor Expanded

Ready to Install

Built especially for heavy oil field use. Portable drilling mast, well servicing mast, pulling truck, floor blocks, derrick guy wires, pipe line anchor assembly. Rock anchors for rock formation. All sizes of anchors wherever dead men are needed. Tests from 8,000 to 50,000 lbs. All Grip-Tite anchor rods have 3" I.D. eye.

Grip-Tite Gauge Line Wiper

Saves Time

Copper line guide grounds static electricity

Cleans both line and bob. Eliminates many gauging hazards. Wiper is below hatch. Oil drippings from line falls back into tank. Saves cleaning and painting jobs. Does not interfere with thiefing. Rigid construction. Replaceable insert made of oil resistant Hycar rubber.

Installed in Hatch Hole

Write for Detailed Information

GRIP-TITE MANUFACTURING COMPANY
P. O. Box 45 Marshall, Texas
Export: R. E. Stokvis & Sons, Inc., 17 Battery Place, N. Y., N. Y.

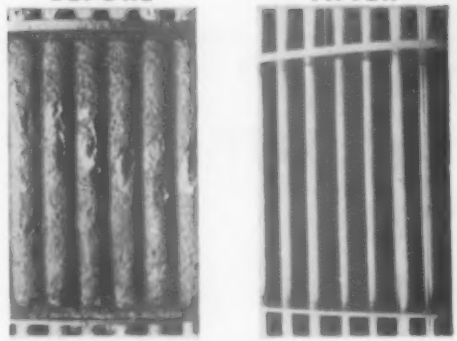
Profit Through Sound

FINANCING

OIL and GAS DEPARTMENT

Mercantile National Bank
DALLAS, TEXAS

BEFORE AFTER



Heat Exchanger bundle before and after cleaning with recommended solvent and improved Oakite Compound 88

Keep Exchangers at Peak Capacity with fast Oakite cleaning

Look at the Heat Exchanger bundle, left above—the one that looks ready for the scrap heap. Can't be much heat transfer taking place with all that build-up of deposit.

Now look at the picture on the right. Same bundle? Yes, the same bundle—...cleaned by Oakite chemical circulation method. Restored to peak performance with minimum out-of-service time.

Similar cleaning short-cuts with Oakite methods and materials are possible throughout the whole processing industry. Cat crackers, fractionating towers, pumps, compressors, drums—each piece of equipment presents a separate cleaning problem, and Oakite has worked out the best *chemical circulation method for cleaning "in place"*.

There's an Oakite man near you whose service is yours, free, for the asking. Call him. Or write for helpful literature to Oakite Products, Inc., 59 Rector St., New York 6, N. Y.

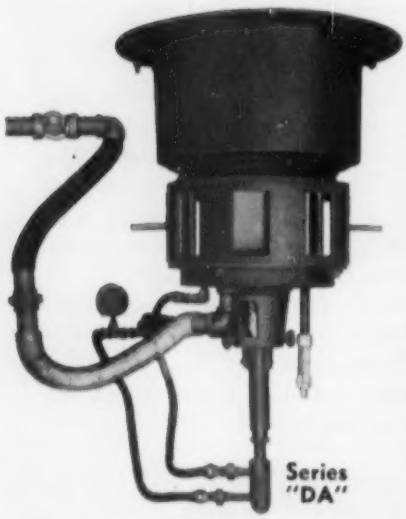
OAKITE

Export Division Cable Address: Oakite

Technical Service Representatives in Principal Cities of U. S. and Canada

OIL
TO BURN?

a
JOHN ZINK BURNER
Will do it



Series "DA"

There is a John Zink Burner for your every need. For example: The new "DA" combination gas and oil burner, designed for vertical or horizontal firing, which incorporates a unique and *thoroughly tested* approach to trouble-free operation. Oil firing is completely divorced from the gas burner, simplifying operation and maintenance. Heat release of approx. 500,000 to 800,000 Btu/foot of flame can be obtained on oil. For detailed information, write for Bulletin DA-356.

JOHN ZINK COMPANY

4401 SOUTH PEORIA TULSA 5, OKLAHOMA

When measuring the costs of a hole in the ground

"Blue Demon"

bit cutting surfaces help you cut hole costs

because the top quality stress-relieved, forged, tool steel blades are structurally strong . . . tougher than your kelly.

The finest quality tungsten carbide inserts are used on all cutting surfaces. A scientifically controlled welding process, developed by Hawthorne, provides maximum metal-to-metal insert bond, preventing loosening while drilling.

A unique dressing procedure of cutting surfaces produces a superior drilling edge, and the diamond point grind provides faster, smoother penetration in hard formations.

These exclusive Hawthorne features, plus the patented replaceable, interchangeable blade design, make the "Blue Demon" Insert Rock Bit first choice for all-formation drilling in the exploration industry.

WRITE FOR ILLUSTRATED CATALOG.

HERB J. HAWTHORNE INC.

P. O. Box 7386 Houston 8, Texas

Inc., Cleveland, Ohio, has just been announced by Bernard R. Krashin, president.

Vickers formerly was with Allied Chemical & Dye Corp. His duties in the Colton organization will be to head and coordinate all activities connected with selling and servicing Colfoam microballoon spheres.

Chain Belt Makes Calkins Southwest Area Sales Mgr.

A. B. Calkins has been appointed assistant district sales manager of Chain Belt Co.'s Southwest oil-field sales. Calkins joined Chain Belt in 1944 as a sales engineer.

In his new position, Calkins will be responsible for customer service throughout the Mid-Continent and Gulf Coast area. He and his staff are located in Houston and Midland, Tex., and Tulsa.

National Supply Opens New Long Beach Store

A new and improved oil-field store has been opened by The National Supply Co. at Long Beach, Calif., replacing a store which the company operated in that city since 1922. Edward M. Williams is the manager, under the supervision of Charles A. Chandler, district manager. The building was designed by Henry Dreyfus, who is consultant to National Supply on the modernization of its oil-field stores. A sales room and offices occupy the front of the building and a large warehouse is at the rear. The structure occupies a 98 by 303-ft. lot. Space is provided for off-street parking as well as for storage of pipe and other heavy materials.

A. D. Bogus Promoted by Young Radiator Co.

A. D. BOGUS

Promotion of A. D. Bogus to sales manager of the industrial and oil-field division was announced recently by F. M. Young, president of Young Radiator Co., Racine, Wis., and Mattoon, Ill.

Bogus has been assistant sales manager 3 years. He will be responsible for sales of the company's cooling and condensing units sold to engine and compressor manufacturers and to the oil, gas, and processing industries.

Rust Engineering Elects Seybold Vice President

George I. Seybold has been elected a vice president of The Rust Engineering Co. He had formerly served as vice president and assistant general manager of Chemical Construction Corp., New York. Seybold

PLAN NOW

Permian Basin

OIL SHOW

Odessa, Texas

OCTOBER 18-21

Write for complete information

Permian Basin Oil Show

219 W. THIRD

ODESSA • TEXAS

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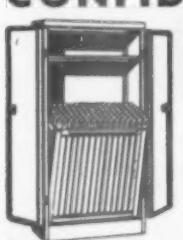


MAP FILE

MT4

Metal cabinet map file with locking doors. 112 tilting tubes. Easy to file and find maps, tracings to 60".

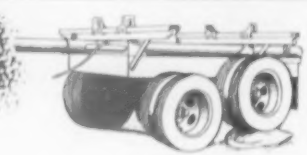
Ideal for home and field offices.

PATENT NO. 1610368 Other Patents Pending

SCOTT-RICE COMPANY

610 S. Main Tulsa 3, Okla.

CROSS COUNTRY



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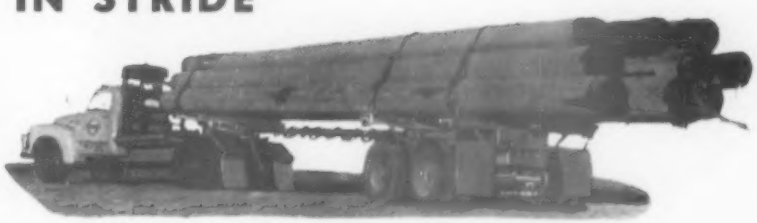


SPENCER-SAFFORD LOADCRAFT PIPELINE TRAILERS

Here is your top-quality pipeline trailer that's really built for cross-country . . . on or off the highway. Double-pivot tandem for axle equalization and longer tire life. Exclusive hi-tensile, pressed-steel frame permits greater payload. Carrying on the Spencer tradition of quality, the Pipeliner combines lightweight with extreme ruggedness at a moderate price.

Choose among Spencer Oil Field Floats, Pole trailers, low-beds. Available in tandem or single axle

Spencer-Safford LOADCRAFT

AUGUSTA KANSAS

Please send me information on your

Pipeliner___ Pole Trailer___ Oil Field Float___

NAME

ADDRESS

TOWN STATE

all signs point the same way...

Throughout the five states now served by United Supply, oil field personnel recognize and follow the signs that unfailingly point to the kind of service the oil industry demands. Such service is always found at your nearest United Supply store.

UNITED SUPPLY
AND *Manufacturing* COMPANY
TULSA, OKLAHOMA

Stores in:
KANSAS, OKLAHOMA, TEXAS, LOUISIANA, AND NEW MEXICO

will make his headquarters in the company's home office in Pittsburgh.

Seybold was with Rust Engineering between 1948 and 1952. During that period he was project manager on several contracts for the chemical, pulp, and paper industries. As vice president, his responsibilities will include direction of the activities of Rust's engineering department.

Hunt Tool Names Fontaine Executive Vice President

T. L. FONTAINE

T. L. (Doc) Fontaine has been appointed executive vice president of Hunt Tool Co., according to Tom Hunt, president. Fontaine will be responsible for the company's new expansion program. In addition to its repair and general-fabricating work for the drilling and production segments of the oil industry, Hunt plans to expand its service to the chemical and electric industries. The regular Hunt line of specialized oil-field tools will also be increased.

The marine division of Harvey, La., will also be expanded. This division builds offshore structures, self-propelled barges, tugs, and does general-fabricating and repair work with floating dry-dock service.

Fontaine was formerly with Alco Products, Inc., and previous to that was president of Atlas Engineering Co.

Oilwell Makes Personnel Changes in Two Areas

The appointment of Otha V. Coke as assistant district engineer, machinery and equipment sales at Liberal, Kans.; transfer of Russell R. Runyon, store manager, from El Dorado to Liberal; and appointment of Gerald E. Miller as store manager of the El Dorado, Kans., store of U. S. Steel's Oil Well Supply Division have been announced by Mark Barkhurst, Mid-Continent area manager of the division. The transfer of Roy A. Johnston, Jr., field representative, from El Dorado, Ark., to Shreveport, La., and appointment of Johnie George Thomas as field representative at Hobbs, N. M., have been announced by William Miskimins, Central Midwest area manager of the division.

Coke joined Oilwell in 1951, in 1952 was appointed field representative at Oklahoma City, and in 1953 assistant district engineer, machinery and equipment sales. In 1954 he was appointed district representative and transferred to El Dorado, Kans. Runyon joined Oilwell in 1950 and in 1953 was appointed store manager at El Dorado, Kans. Miller was employed by Oilwell in 1949 at Ellinwood, Kans., in 1952 was transferred to McPherson, Kans., and in 1953 to Arkansas City, Kans.

Johnston was employed in 1952 at Shreveport. In 1955 he was appointed field representative and transferred to El Dorado, Ark. Thomas joined Oilwell at Odessa in 1952 and was transferred to McCamey, Tex., in 1953. He was located at the Odessa store prior to his present appointment.

Kobe Transfers Tullos and Lewis

A. R. TULLOS

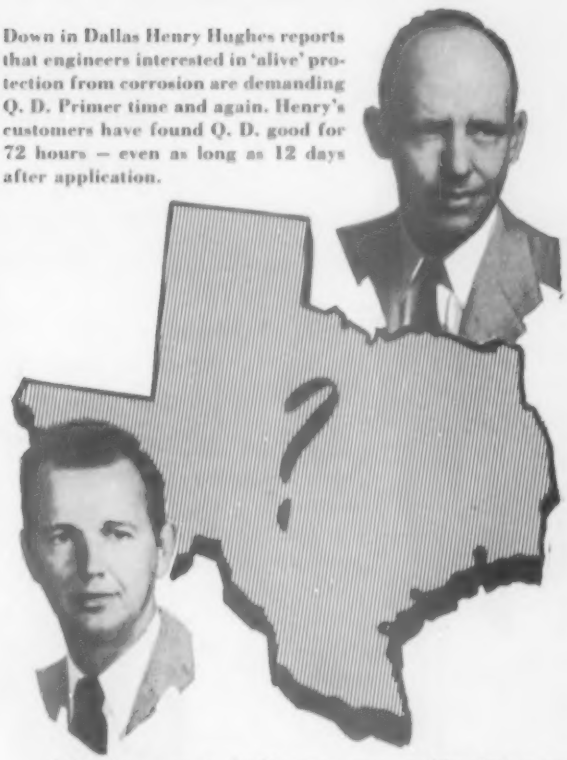
J. T. LEWIS

A. R. Tullos, Gulf Coast division sales manager of Kobe, Inc., is being

WHEN IT COMES TO SERVICE

COME TO REILLY

● Down in Dallas Henry Hughes reports that engineers interested in 'alive' protection from corrosion are demanding Q. D. Primer time and again. Henry's customers have found Q. D. good for 72 hours — even as long as 12 days after application.



● Pipeline men in the Houston area are like their contemporaries in other localities — they want good protective coatings and practical suggestions from the manufacturer concerning application procedures. Bill Sandland is ready to supply help at all times.

Reilly COAL TAR PRODUCTS

Reilly Tar & Chemical Corporation

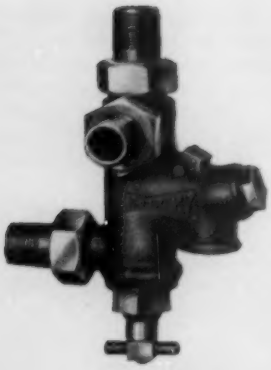
MERCHANTS BANK BUILDING, INDIANAPOLIS 4, INDIANA

Sales Offices in Principal Cities

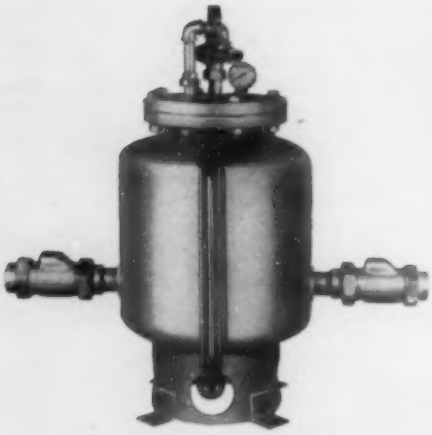
1209 National City Building, Dallas 1, Texas

Bermac Building, 4101 San Jacinto, P. O. Box 8188, Houston 4, Tex.

GAGE VALVES



INJECTORS



CYCLING JET PUMPS

PENBERTHY PRODUCTS FOR PETROLEUM . . .

MEASURE • MIX • PUMP • WASH • EXHAUST • AGITATE • COMPRESS • ATOMIZE
CIRCULATE • AERATE • INJECT • CONDENSE • EXTRACT • AMONG OTHER USES

SUMP PUMPS

● Simplifying systems, saving time and money, guaranteeing accuracy — Penberthy products serve the petroleum industry directly and as components of equipment. Penberthy is equipped and staffed to engineer and produce dependable products. We'll be glad to send you catalogs and literature detailing our products and services. You are almost certain to find one or more ways we can contribute to your operations.

WATER HEATERS

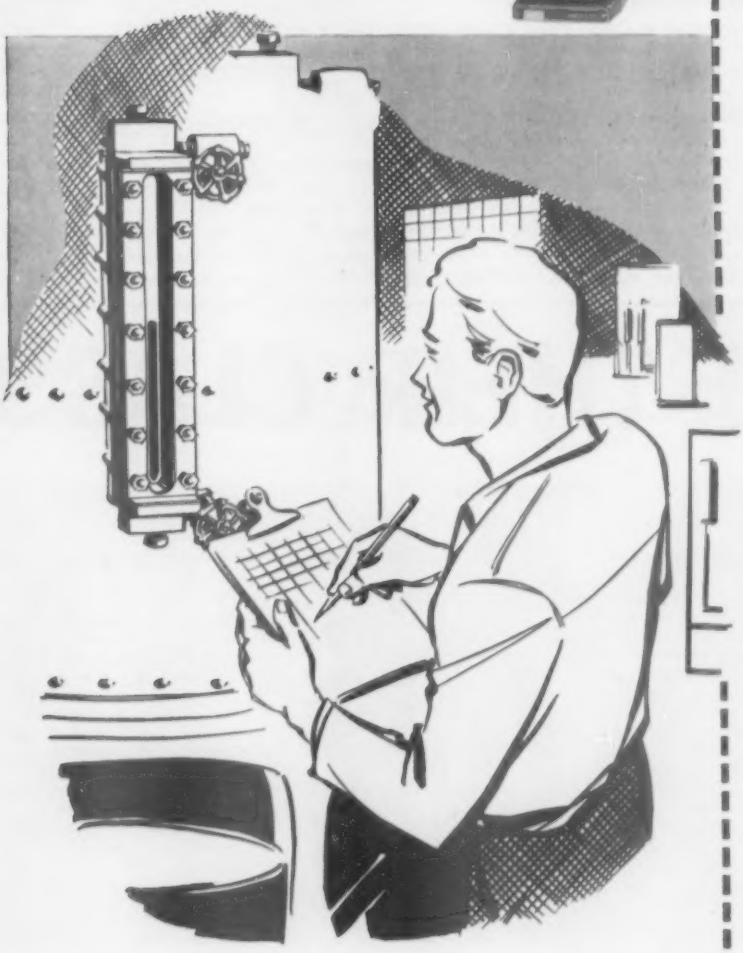
PENBERTHY

DIVISION OF BUFFALO

1242 Holden Avenue

LIQUID LEVEL GAGES

JET PUMPS
(Ejectors, Eductors, Exhausters, Syphons)



INJECTOR CO.

ECLIPSE CORPORATION

Detroit 2, Michigan

Penberthy Gages feature, as standard, the exclusive "Raised Face" to facilitate cleaning and replacement . . . assuring perfect alignment of frame with glass and gasket. They are accurate, rugged and reliable. Available in standard or special designs, sizes and materials. The line includes: Reflex, Transparent, High Pressure, Frost-Free, Heating Tube and Heating Chamber, Welding Pad, Large Chamber and Inclined Gages as well as Explosion-Proof Illuminators.

Penberthy Gage Valves, with exclusive "Floating Shank", save 50% and more on installation costs alone . . . eliminate dangerous strains common to forced installations. The line includes: Tubular and Threaded gage valves. Jacketed gage valves, Instrument valves. Wire glass, plate glass and sheet metal guard protectors.

Penberthy Ejectors are available in bronze, iron, stainless steel, plastic and other materials . . . in standard or made-to-order designs. They provide a simple, efficient means of handling liquids, gases, solids in suspension and even dry materials. Nothing to get out of order, low cost, small size, practically noiseless.

Penberthy Cycling Jet Pumps are gas, steam, or air operated with a minimum of moving parts. Superior for injecting chemicals into vessels or lines, transferring fluids and for pumping operations in hazardous locations.

Penberthy Water Heaters utilize steam to heat water or any other liquid to any temperature up to 212°F. High grade bronze construction. Compact. Efficient.

Penberthy Sump Pumps are available in a variety of sizes and capacities, bronze construction, automatic-electric, standard, submersible and explosion-proof.

transferred to Midland, Tex., where he will be West Texas division sales manager, according to Ray Elner, manager of hydraulic sales. In this move J. T. Lewis, who has headed the West Texas division, will go to Houston as Gulf Coast division sales manager.

Gerrard Heads New Houston Office of Darwin H. Clark

Darwin H. Clark Co., Los Angeles advertising agency, has opened a Houston office in the new Bank of the Southwest Building and has appointed James W. Gerrard, vice president, as resident manager. Gerrard has been account supervisor of the agency's Los Angeles office and previously was head of the advertising and sales-promotion department of Beckman Instruments, Inc.

The Clark agency handles industrial, consumer, and financial accounts, including leading oil-tool, chemical, electronic, instrument, and metal-processing companies.

Union Center To Be a Hub of Wichita Oil Activity

Directors of the new Union Center building are shown above. Seated are: Jack Hinkle, Mrs. O. A. Beech, and Sam P. Wallingford, president. Standing, Lance Coffey, Owen McEwen, John Jenner, and C. R. Sullivan. Directors not shown are Kean Tilford and Carroll Willis.

A new ten-story office building, still under construction in Wichita, Kans., is fast shaping up as the oildorado of the Midwest. Wichita's Petroleum Club has leased the entire second floor of the proposed million-dollar Union Center.

Oil men apparently felt that the building was to be Wichita's oil center. According to officials, all space in the new home building of Wichita's Union National Bank is taken, and there is a waiting list. All but six of the building's 60 or more firms will be in some phase of the oil business.

Wichita's Petroleum Club started 7

HEAD OF THEIR CLASS

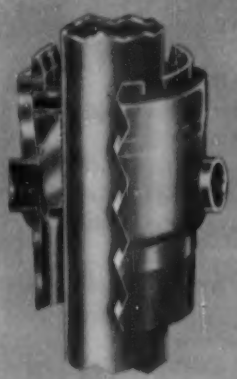
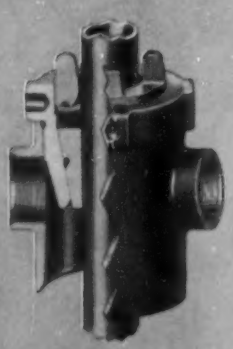


FIG. 91

Simplicity and compactness, for ease of installation and neatness of hook-up, are incorporated into the Larkin Casing Head (2000 psi test, 1000 psi working pressure.) It is designed to provide a safe and economical means of suspending and packing off casing strings. This head has been tested to support 225,000 lbs., equivalent to 5600' of 7", 20-lb. casing with a safety factor of 2.



TYPE L

A new member of the Larkin Well Head line, the Type L Tubing Head fills a need in low pressure areas where economy may be effected with complete safety. It is forged steel construction, full opening, 2000 lb. psi, top of body threaded 7" API to accommodate control equipment, hinged three-segment slips, 2" or 3" side outlets.

For detailed information on these and other Larkin Tubing and Casing Heads, please refer to your Larkin Catalog or talk to your Larkin Representative. All Larkin Equipment is available through your supply store.

LARKIN LEADERSHIP HAS BEEN EARNED

years ago with 200 members and 300 sq. ft. of space in the basement of Hotel Lassen. Today, with 932 active members, the club is overflowing its 7,800 sq. ft. in the KFH building, where the club moved in 1952. More than doubling its present space, the new club will have 20,000 sq. ft. in the Union Center building. Some 2,500 sq. ft. of the space has been sublet to

The nearly completed Union Center building in Wichita.

business interests pending further growth of the oil men's club.

The oil operations moving to the new Union Center will bring together business now scattered in nine major buildings in downtown Wichita. Gulf Oil Corp. will occupy the entire third floor of the building. Cities Service Oil Co. will occupy 4,422 sq. ft. on the street level. Vickers Petroleum Co., Inc., has leased 3,373 sq. ft. Other larger oil space tenants in the building will include Halliburton Oil Well Cementing Co., 3,062 sq. ft.; Rine Drilling Co., 2,597; Earl F. Wakefield, 2,192; Pony Oil Co., 2,072; and Musgrove Petroleum Co., Inc., 2,232 sq. ft.

Second-floor space subleased by the Petroleum Club will house the executive offices of Kansas Independent Oil and Gas Association, office space for William Jackson, and the Seis-Tech Exploration Co.

Hill & Christopher Adds Roy F. Irvin to Its Staff

Roy F. Irvin has joined the staff of Hill & Christopher, Los Angeles. In addition to functioning as account executive on the accounts he has handled for long periods, Irvin will work on Halliburton Oil Well Cementing Co., TelAutograph, Oil Base, and other Hill & Christopher accounts.

Republic Promotes Prater, Anthis, and Bergin

R. A. PRATER

F. H. ANTHIS

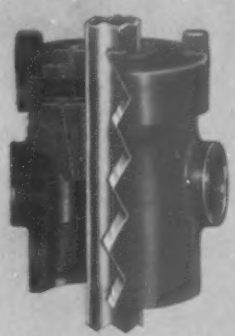
R. A. Prater, formerly Republic Supply Co.'s district manager at Wichita Falls, Tex., has been promoted to assistant general manager of sales at the general office at Oklahoma City; F. H. Anthis, formerly city sales representative at Oklahoma City, has been named district manager at Wichita Falls; and J. C. Bergin has been made district manager with headquarters at Wichita, Kans. These promotions were announced by M. N. Amsden, vice president and general manager of sales for Republic Supply.

Prater joined Republic in 1947 as a store manager, later advancing to assistant district manager at Abilene and to district manager at Wichita Falls.

for medium pressure wells

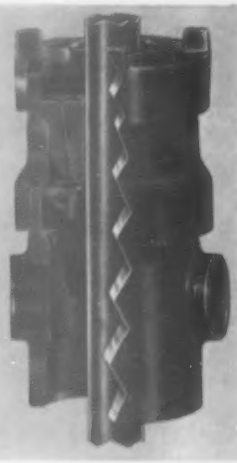
TYPE R

The Larkin Type R. Tubing Head is a conversion from the Type SR Head. This ease of conversion makes it possible to use the same stripper adapter and Neoprene stripper when working on any well equipped with a Larkin Tubing Head.



TYPE SR

The Larkin Type SR Tubing Head is a slip suspension head, equipped with a Neoprene Stripper which serves as a blow-out preventer and oil saver while tubing is being pulled or run. It is very suitable where higher pressures might be encountered.

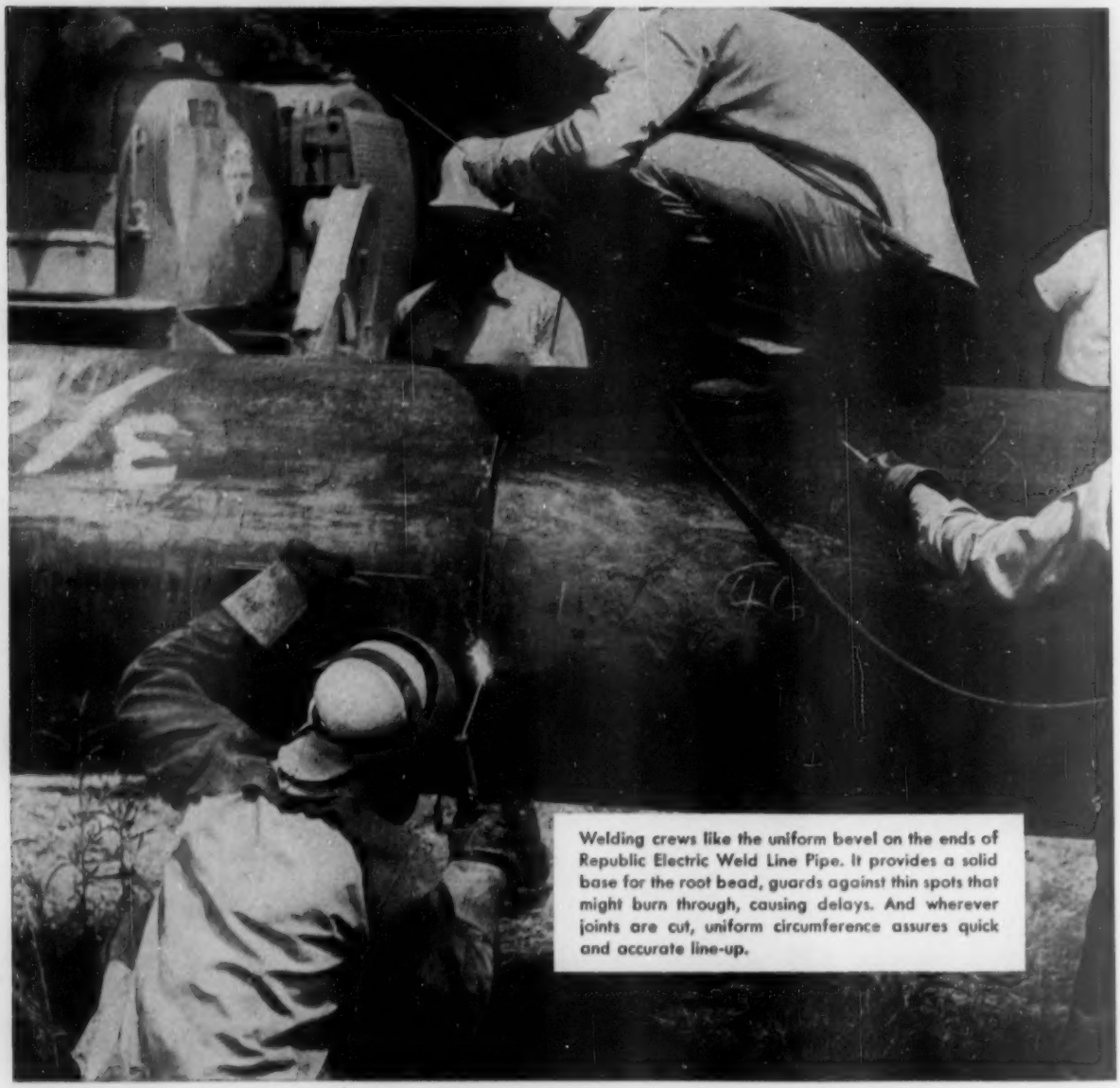


LARKIN PACKER COMPANY, INC.
WAXAHACHIE, TEXAS

LARKIN
...Through Your Supply Store

BY YEARS OF DEPENDABLE PERFORMANCE

You get more miles of welds per day



Welding crews like the uniform bevel on the ends of Republic Electric Weld Line Pipe. It provides a solid base for the root bead, guards against thin spots that might burn through, causing delays. And wherever joints are cut, uniform circumference assures quick and accurate line-up.

REPUBLIC

REPUBLIC STEEL

World's Widest Range of Standard Steels

when you're laying

REPUBLIC ELECTRIC WELD LINE PIPE

Alignment is fast with Republic Electric Weld Line Pipe because you don't waste a lot of time searching for true-fitting ends. Circumference of every length is always constant. Joints line up quickly and accurately without delay.

Pipe walls are uniform in thickness. This even distribution of metal means no thin spots to cause burn-throughs. Strong welds are easier to make. And once the line is under pressure, every inch of the wall is dependable.

Smooth field and shop bends are easy to make because Republic Electric Weld Line Pipe has high ductility. Furthermore, high yield strength makes it ideal for high-pressure lines.

Follow the experience of hundreds of successful pipeline companies all over the world. Install dependable, trouble-free Republic Line Pipe and get more miles of pipeline in the ditch every day. Electric Resistance Weld comes in sizes 2⅛″ through 16″ O.D.; Electric Fusion Weld from 24″ through 30″ O.D.; and Continuous Butt Weld from ¼″ through 4″ nominal.

Contact your local Republic sales office. They will be glad to work with you on any line pipe problem. *For descriptive literature—mail coupon.*

TRUSCON STEEL BUILDINGS ARE ECONOMICAL AND EASY TO ERECT. Fabricated at Republic's Truscon Division, they're designed specially for you, to suit your particular requirements. You'll get a building that's fire-resistant, well-lighted, properly ventilated and easy to maintain. Truscon engineers will help you from design to erection. Send for catalog.

WHEN YOU NEED STEEL PIPE IN A HURRY, call your Republic Pipe Distributor for immediate delivery. He's ready to deliver one length or a whole carload. Republic Steel Pipe, made by the improved Continuous Butt Weld Process gives extra years of service—yet costs no more than ordinary pipe. It has uniform strength and ductility, is easily threaded, readily bent. Mail coupon for literature.

REPUBLIC SRK PLASTIC PIPE IS HIGHLY RESISTANT TO CORROSION. Rugged and extremely light in weight, it can be cut with an ordinary handsaw, joined quickly with solvent-welded, sleeve-type fittings. It's unaffected by sour crudes, soil acids, alkalies, and electrolysis. A big money-saver. Send coupon for literature.

STEEL

and Steel Products

REPUBLIC STEEL CORPORATION
Dept. C-1714
3112 East 45th Street, Cleveland 27, Ohio

Please send me more information on:

☐ Fusion Weld Line Pipe ☐ Truscon® Steel Buildings
☐ Resistance Weld Line Pipe ☐ SRK Plastic Pipe
☐ Steel Pipe

Name_____ Title_____

Company_____

Address_____

City_____ Zone_____ State_____

Always tops
in Quality-now
IMPROVED
to meet the demands of
faster, deeper drilling!

Used Exclusively On
World's Deepest Well
In Louisiana!

Sold through your favorite supply store

MONEY BACK
GUARANTEE

USE JIMMIE GRAY
DOPE BRUSHES

PETROLEUM
DISTRIBUTING
COMPANY
BOX 703 · HOUSTON, TEXAS · CApitol 4-9645

Anthis began work with Republic in 1943 as a floorman. He was transferred to Cement, Okla., as store manager, then manager of the Elmore City store, and moved to Oklahoma City as city salesman. He will now have under his supervision stores at Wichita Falls, Electra, Nocona, Olney, and Whitesboro, Tex.

Bergin joined Republic in 1948 as floorman, advanced to store manager at Kermit, Tex., city sales at Midland, and was special sales representative at Houston. In his new position he will supervise stores at Arkansas City, Ellinwood, and Medicine Lodge, Kans., and Pawhuska, Okla.

ABP Award Won by Brennan, Prepared Campaign of PESA

Petroleum Equipment Suppliers Association has won the award of merit given annually by Associated Business Publications. PESA won the award for its public relations campaign produced and prepared by J. Earl Brennan, president of Brennan Advertising Agency. Two awards were given, one for the association and one for its advertising agency.

Shown are J. Earl Brennan, receiving the award for the agency; George O'Leary, president of Houston Oil Field Materials Co., who is chairman of the PESA public relations committee; and H. R. Safford, Jr., executive secretary of PESA, who with O'Leary received the duplicate award given to PESA. The association was also represented by M. E. Montrose, retiring president of PESA.

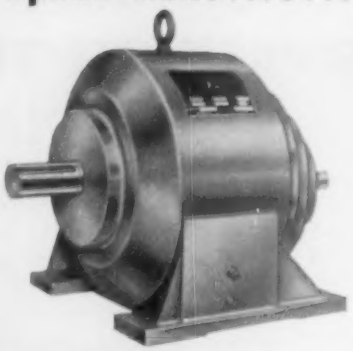
Bowen Is Weco's South Texas Representative

Mat (Mack) Bowen has been appointed sales representative for Well Equipment Manufacturing Corp., according to John Gates, Weco sales manager. Bowen will be headquartered in Corpus Christi to serve the South Texas area.

For the past several years Bowen has worked in the Gulf Coast area. He roughnecked in this section for 3 years prior to sales and service work for two oil-country manufacturing companies.

As South Texas representative for Weco, a division of Chiksan Co., Bowen

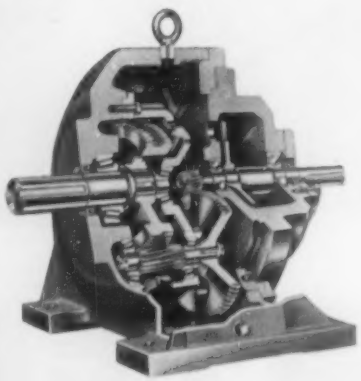
New IN-LINE
Speed Reducers...



FLEXIBLE...
ECONOMICAL...
EFFICIENT

The streamlined compactness of these new units makes them ideal for mounting in places where space is limited. Accurately manufactured helical gearing, rugged housing construction and precision mounted shafts and bearings assure long, dependable service, with a minimum of maintenance. The *new* Phillie Gear "IN-LINE" Reducers are available in 18 different sizes and gear reductions to suit most types of service. Available for mounting in various positions . . . Standard AGMA ratios from 1.25:1 to 205:1.

Send for illustrated Literature describing these money-saving Speed Reducers.



phillie gear
PHILADELPHIA GEAR WORKS, INC.
ERIE AVE & G STREET PHILADELPHIA 34, PENNA.
Offices in all Principal Cities
INDUSTRIAL GEARS & SPEED REDUCERS
LIMITORQUE VALVE CONTROLS
FLUID AGITATORS · FLEXIBLE COUPLINGS
Virginia Gear & Machine Corp. • Lynchburg, Va.

WICKWIRE ROPE DISTRIBUTORS WEAR MANY HATS

Wickwire Rope distributors are men who wear many hats. They are at home in the headgear typical of the numerous and varied industries they serve—the marine and fishing trades, the oil fields, construction, logging and many other industries having specialized wire rope needs.

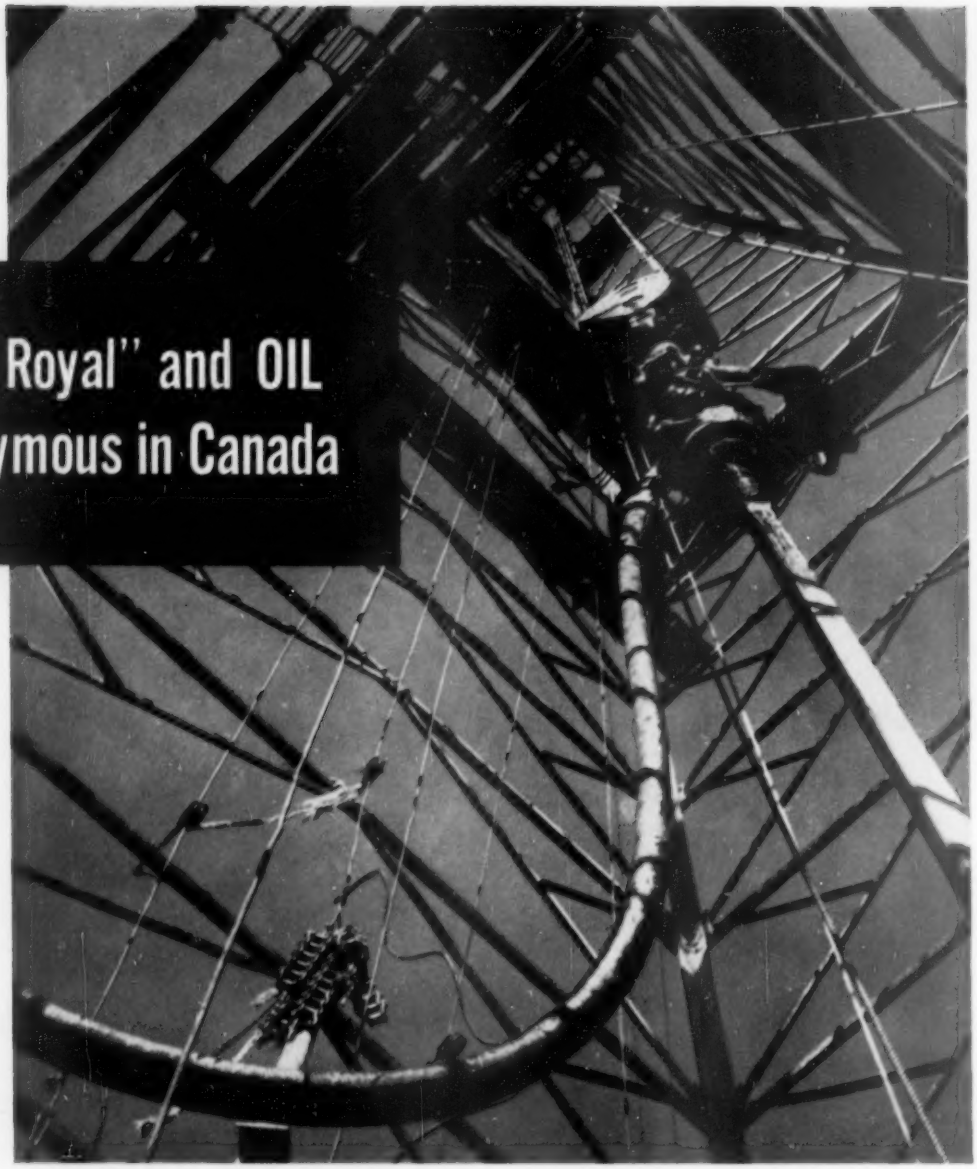
These men aren't hat models—they can wear these hats because of their long experience in the industries they serve. Add to this their intimate knowledge of local conditions and their comprehensive Wickwire Rope stocks, and you'll see that your Wickwire Rope distributor is the man who can be of great help to you.

Yes, your Wickwire Rope distributor is a good man to know. He's quality people handling quality products. Buy your wire rope and wire rope slings from him. You'll find that the many valuable services he offers far outweigh any apparent price advantage you might gain by buying direct.

CF&I WICKWIRE ROPE A CF&I PRODUCT

A PRODUCT OF THE COLORADO FUEL AND IRON CORPORATION

3154



"The Royal" and OIL synonymous in Canada

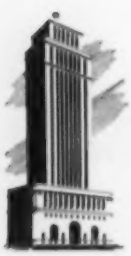
There are good sound reasons why The Royal Bank of Canada has long been familiarly known as "Canada's oil bank".

One reason is *experience*. "The Royal's" association with oil men dates from the earliest days of oil and gas development in Canada.

Another reason is *facilities*. Today more than 290 Royal Bank branches serve all the important areas of commercial oil production as well as many of the newer fields of active development and rich promise.

Each branch provides complete "on-the-spot" service to oil and gas men throughout the Western Canadian provinces. To supplement this service, the "Royal" maintains at Calgary a well-equipped and competently staffed Oil and Gas Department, geared to the specialized needs of the industry. Your enquiries are invited.

We do not provide information on oil securities.



THE ROYAL BANK OF CANADA

Canada's Largest Bank

Head Office: Montreal

Total assets exceed 3¼ billion dollars

Over 850 branches in Canada, the West Indies, Central and South America, New York, London and Paris.

The Royal Bank issues bulletins from time to time covering statistics, regulations, tariffs, oil and gas financing, and kindred subjects. These are free on request. For a list of current bulletins write to The Royal Bank of Canada, Oil and Gas Department, 409 – 8th Avenue West, Calgary, Alta.

will represent Weco unions, blocks, and compounds as well as Chiksan swivel joints, steel rotary hoses, and mud guns. Before assuming his new duties, Bowen spent a month at Weco's Houston plant learning the products and policies of both companies.

Cessna Promotes Roscoe, Reorganizes Departments

F. L. ROSCOE

Fred L. Roscoe, eastern divisional sales manager of Cessna Aircraft Co. has been named domestic sales manager, according to Frank Martin, Cessna's marketing manager, commercial aircraft. The public relations department has been transferred to the sales department and will be under the direct supervision of Bob Chatley, director of sales promotion and advertising.

Roscoe joined Cessna in 1953 as a regional sales manager in the Northwest territory. He was promoted to eastern divisional sales manager in 1954. Chatley has been with Cessna 5½ years and has been director of sales promotion the past 5 years.

J&L Gives Guinn, Whiteker District Sales Promotions

J. K. Guinn, formerly general salesman at Oklahoma City, has been named district sales manager of the central and southern Oklahoma district of Jones

J. K. GUINN

G. A. WHITEKER

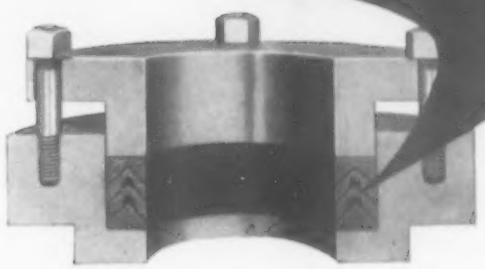
& Laughlin Supply Division, according to Rainey Elliott, president of the firm headquartered in Tulsa. Guinn succeeds L. R. Roberts, who retired after 28 years of service with Jones & Laughlin Supply Division.

In the West Texas district, Glen A. Whiteker has been appointed assistant district sales manager to supervise the western section of the district out of Odessa, Tex.; and H. H. Ray, assistant district sales manager based in Abilene, Tex., will be in charge of the eastern section. F. L. McFarland, Midland, Tex., is district sales manager of the West Texas district.

Guinn, who previously was general

ONE OF THE GARLOCK 2,000

SHALLOW STUFFING BOXES NEED THIS KIND OF "GRIP"



GARLOCK
431 CHEVRON* PACKING

tightens as pressure increases, eases off as pressure decreases, assuring no-leak sealing and minimum friction on rams, plungers, reciprocating rods, etc.

LOOK AT THESE SERVICE REPORTS:

- On hydraulic press with 40" dia. ram, operating at 6000 psi pressure, .006" clearance between ram and gland, GARLOCK 431 CHEVRON size 40" x 41½" by only 2" deep gave 14 years service.
- On hydraulically operated clutches with ¾" cylinder, 500 psi pressure, ¾" travel, operating intermittently. Neither leather cups nor "O" rings worked well. Now packed with GARLOCK 431 CHEVRON ⅜" x ¾" x 17/32" deep. Result: smooth, positive sealing.

And remember, 431 CHEVRON Packing is only one of "the famous GARLOCK 2,000" . . . two thousand different styles of packings, gaskets, and seals to meet *all* your needs. It's the *only* complete line . . . it's one reason you get unbiased recommendations from your GARLOCK representative. Call him today or write for Folder AD-115.

*Registered Trademark

THE GARLOCK PACKING COMPANY,
Palmyra, New York

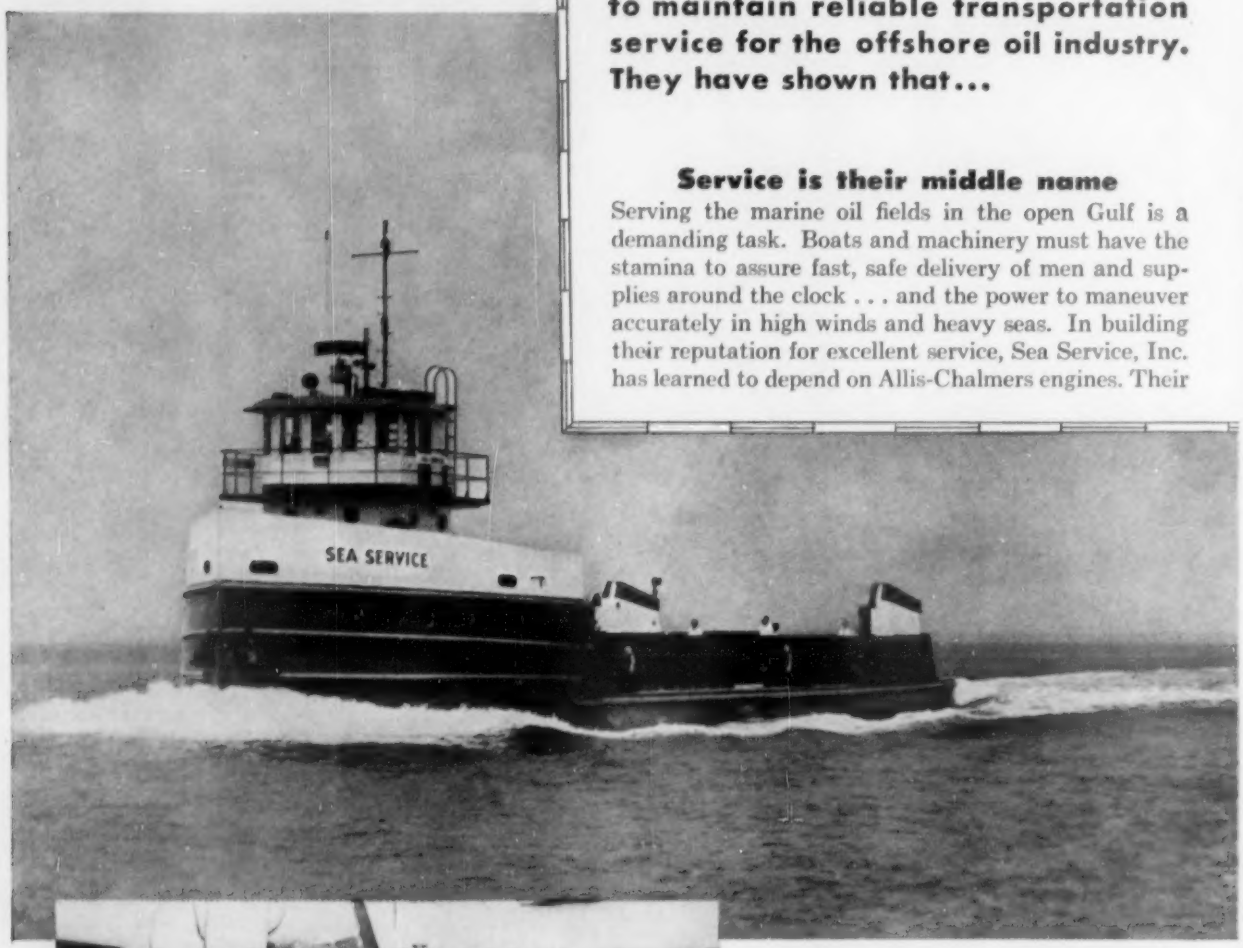
For Prompt Service, *contact one of our 30 sales offices and warehouses throughout the U.S. and Canada.*

GARLOCK

Packings, Gaskets, Oil Seals, Mechanical Seals, Rubber Expansion Joints

Sea Service, Inc. depends on over 10,000 HP of Allis-Chalmers diesels

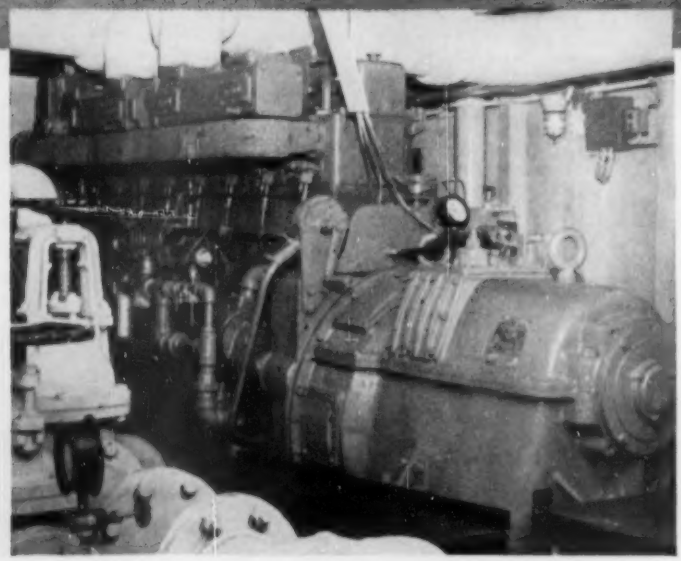
to maintain reliable transportation service for the offshore oil industry. They have shown that...



Service is their middle name

Serving the marine oil fields in the open Gulf is a demanding task. Boats and machinery must have the stamina to assure fast, safe delivery of men and supplies around the clock . . . and the power to maneuver accurately in high winds and heavy seas. In building their reputation for excellent service, Sea Service, Inc. has learned to depend on Allis-Chalmers engines. Their

M/V Sea Service is one of six large supply ships in the Sea Service, Inc. fleet. It is 135 ft long, 32 ft wide and is powered by two Allis-Chalmers 516-hp super-charged diesel engines. It carries 600 long tons of deck cargo — mud, cement pipe and other supplies or equipment.



This is one of two 516-hp Allis-Chalmers engines which power the supply ship *Sea Service*. Counting auxiliary engines, the present fleet of Sea Service, Inc. uses over 10,000 hp in Allis-Chalmers diesels.

fleet of six large supply vessels and seven modern crew boats utilize . . .

Over 10,000 HP of Allis-Chalmers diesels

The Allis-Chalmers marine diesels now in Sea Service boats total 8,658 hp in main propulsion engines and 1,510 hp powering generators and auxiliaries — all providing the kind of dependable power essential to this type of service.

This proven dependability and economy is available to you for almost any power requirement. So before you repower or specify any engine in a new boat, ask your Buda Division Marine or Oilfield Dealer for all the facts. Write for free catalogs.

ALLIS-CHALMERS, BUDA DIVISION, MILWAUKEE 1, WISCONSIN

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

BM-5

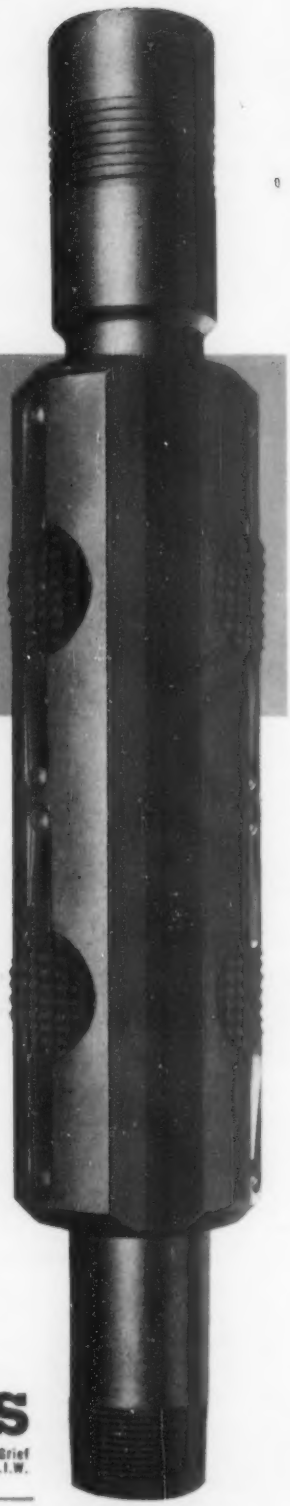
The *Gulf Service*, top, and the *Buda Driller*, just above, are two more Sea Service vessels that are familiar to the eyes of offshore oilfield people. The Allis-Chalmers marine diesels on the *Gulf Service* consist of two 2505 main propulsion engines and two 468 generating units, and on the *Buda Driller*, a pair of turbo-charged 1125 main engines and BD77 generating sets.

The 82-ft *Oil Service* is one of seven "outside" crew boats operated by Sea Service, Inc. Powered by two 300-hp Allis-Chalmers continuous-duty engines, it is Coast Guard-certified to carry 31 passengers.

Tying up to "Mr. Charlie" in calm waters like this is duck soup for the utility tender *Pelican Driller*. Like all ships in the Sea Service, Inc. fleet, it has ample reserve power to maneuver quickly along-side offshore rigs in any weather short of a full-scale hurricane. The *Pelican Driller* develops 680 hp with its two Allis-Chalmers supercharged marine engines, and has two Allis-Chalmers auxiliary engines of 114 hp.

ANNOUNCING

THE NEW TIW TYPE "HR-6" HYDRAULIC HOLD-DOWN



Patent applied for.

FOR ANY PRODUCTION TYPE PACKER

The New TIW Type "HR-6" Hydraulic Hold-Down is an improvement on the regular TIW Type "H" Hydraulic Hold-Down which has been providing satisfactory oil field service for several years throughout the world.

The new TIW Type "HR-6" provides increased slip area, with 6 slips for greater gripping, and features three large bypass grooves to speed running into the hole.

Like the Type "H", the new TIW Type "HR-6" Hydraulic Hold-Down offers these features:

- ★ Uses tubing pressure to hold packer down. The higher the pressure, the tighter the grip!
- ★ Slip holding area and piston area selected to assure positive gripping regardless of tubing pressure and casing size.
- ★ Proved slip-type teeth for positive grip with minimum damage to casing.
- ★ Polished piston and cylinder bores.
- ★ Carburized piston slips for long wear.
- ★ Parkerized throughout to prevent corrosion.
- ★ Nickel-plated springs keep slips in retracted position—to prevent wear while running in hole.
- ★ Fishing neck standard equipment.

TEXAS IRON WORKS

Manufacturers of: T.I.W. Portable Rigs . . . T.I.W. Safety Joints . . . T.I.W. Rotary and Casing Slips . . . T.I.W. Grief Stem Safety Valves . . . T.I.W. Gas Lifts . . . T.I.W. Packers for every purpose . . . T.I.W. Pump Chambers . . . T.I.W. Mudmasters . . . T.I.W. Drillmasters . . . and many other oil field tools.

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6475

salesman at Oklahoma City, joined the firm in 1920 as a storeman. Following promotions in various store and sales capacities, he was made district sales manager of the Michigan district in 1944. In 1954, when the Michigan district was integrated with the present Illinois-Kentucky district, Guinn returned to Oklahoma as a general salesman based in Oklahoma City.

Whiteker started as a storeman in 1945 and later was promoted to local store manager at Best, Tex. He then served as manager of the Casper, Wyo., store and as a salesman at Hobbs, N. M.

Web Wilson Appoints Israel Selling Agent

Raphael ben Yosef, of E-G Supply & Engineering, Jaffa, Israel, has been appointed as selling agent for Web Wilson Oil Tools, Inc. Ben Yosef has had oilfield experience and has recently completed an extensive training course at the Web Wilson factory in Los Angeles.

W-K-M Dedicates New Plant At Missouri City, Tex.

The new multimillion-dollar W-K-M Manufacturing Co., Inc., plant was dedicated recently. Taking part in the ceremony were J. S. Downs, president of W-K-M; C. J. Hardy, Jr., chairman of the board of ACF Industries, Inc., of which W-K-M is a subsidiary; the Honorable Ben Ramsey, lieutenant governor of Texas; Ben C. Belt, president

J. S. Downs, president of W-K-M, addresses about 1,000 employes and 100 visitors at the dedication ceremonies of the new W-K-M Manufacturing Co. plant in Missouri City, Tex.

Use...

MARATHON'S CALCIUM LIGNOSULFONATE TO CONDITION LIME-BASE MUDS

This product, tradenamed KEMBREAK*, is the only lignosulfonate proved by years of successful use in oil well drilling.

KEMBREAK is especially useful in reducing viscosity and gel strength in lime-base drilling fluids. It performs equally well in conventional lime muds, low lime-low caustic muds, and emulsion muds.

KEMBREAK is particularly suited for use as a breakover chemical, during the initial stages of conversion from an ordinary mud to a lime-base mud, where it serves to minimize increases in viscosity and gel strength which normally occur.

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It takes a lot of courage and a lot of money for Joe Roughneck to drill the oil wells necessary to supply ever-increasing demands. Despite fabulous stories . . about 7 out of 8 are dry holes.

But Joe, spirit of the oil industry, keeps drilling . . keeps bringing in wells . . to satisfy needs of the public, of industry and the Free World's defense. Lone Star Steel . . Joe's Friend . . is proud to supply the API pipe required by his stepped up drilling schedules.

Lone Star . . most modern pipe plant in the oil area . . turns out API quality casing, tubing and line pipe day and night for Joe's special needs.

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of the Houston Chamber of Commerce, the Honorable R. A. Stallings, mayor of Missouri City; John Hampton, district representative of the International Association of Machinists; and Rev. James T. Garrett, pastor of the Almeda Methodist Church of Almeda, Tex.

Ramsey made the principal address, with short talks by Downs, Hardy, and Belt. At the close of the program, the visitors toured the 12-acre plant. Guided tours continued through the afternoon and evening, and on the second day the plant was open to the public.

Gerrard Directs TI Geophysical Research

JOHN GERRARD

Dr. John A. F. Gerrard is now director of geophysical research in the central research division of Texas Instruments, Inc., Assistant Vice President Gordon K. Teal has announced. Gerrard is in charge of basic and exploratory research into technique and instrumentation for geophysical exploration.

In the Texas Instruments organization, contract - geophysical exploration is conducted by subsidiary Geophysical Service, Inc. and its eight affiliated companies. The manufacture and marketing of geophysical instruments is conducted by subsidiary Houston Technical Laboratories.

Gerrard was formerly director of geophysical research for Houston Technical Laboratories. He replaced Dr. Hal J. Jones, who is now chief engineer of HTL.

Prior to his coming with the TI companies in 1954, Gerrard was a vice president of Electro-Technical Laboratories, Houston, and before that was a technical supervisor with Northwest Seismic Surveys, Calgary, and a geophysicist with California Standard Co. of Canada.

Otis Purchases Bryan Gas Lift Equipment Co.

Otis Engineering Corp., manufacturing affiliate of Otis Pressure Control, Inc., has announced the purchase of Bryan Gas Lift Equipment Co. of Fort Worth, according to Herbert C. Otis, Jr., executive vice president.

Bryan Gas Lift Equipment Co., a pioneer in the development of gas-lift equipment, still holds many of the basic patents on this equipment. Much of the equipment is designed to operate with Otis wire-line tools for permanent

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BEFORE

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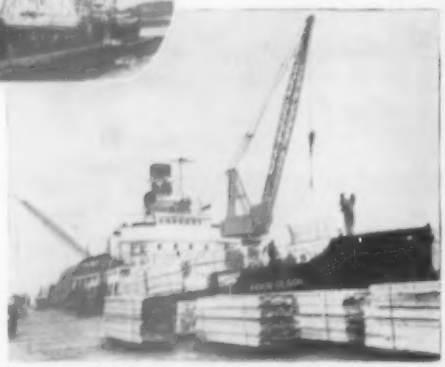

The net results of converting from old type rigging: Speeds up cargo handling — reduces idle port time — cuts maintenance cost. These self-contained MARINERS operate independently of ship's power.

Features incorporated in the MARINER design include: One-piece cast gear case — a protection against salt spray • Self-aligning centerpost trunnion • Turntable load rollers plus replaceable hook shoes • Large diameter roller path • Worm type independent boom hoist • Large diameter swing brake • Disc type clutches • Straight-in-line engine mounting with torque converter plus many other important features. The LIFT and CONTROL ability of the MARINER permits loading and unloading with speed and accuracy. The full range vision safety cab enables the operator to see what he is doing at all times. Here's a machine constructed for your type of Cargo handling. Get the facts.

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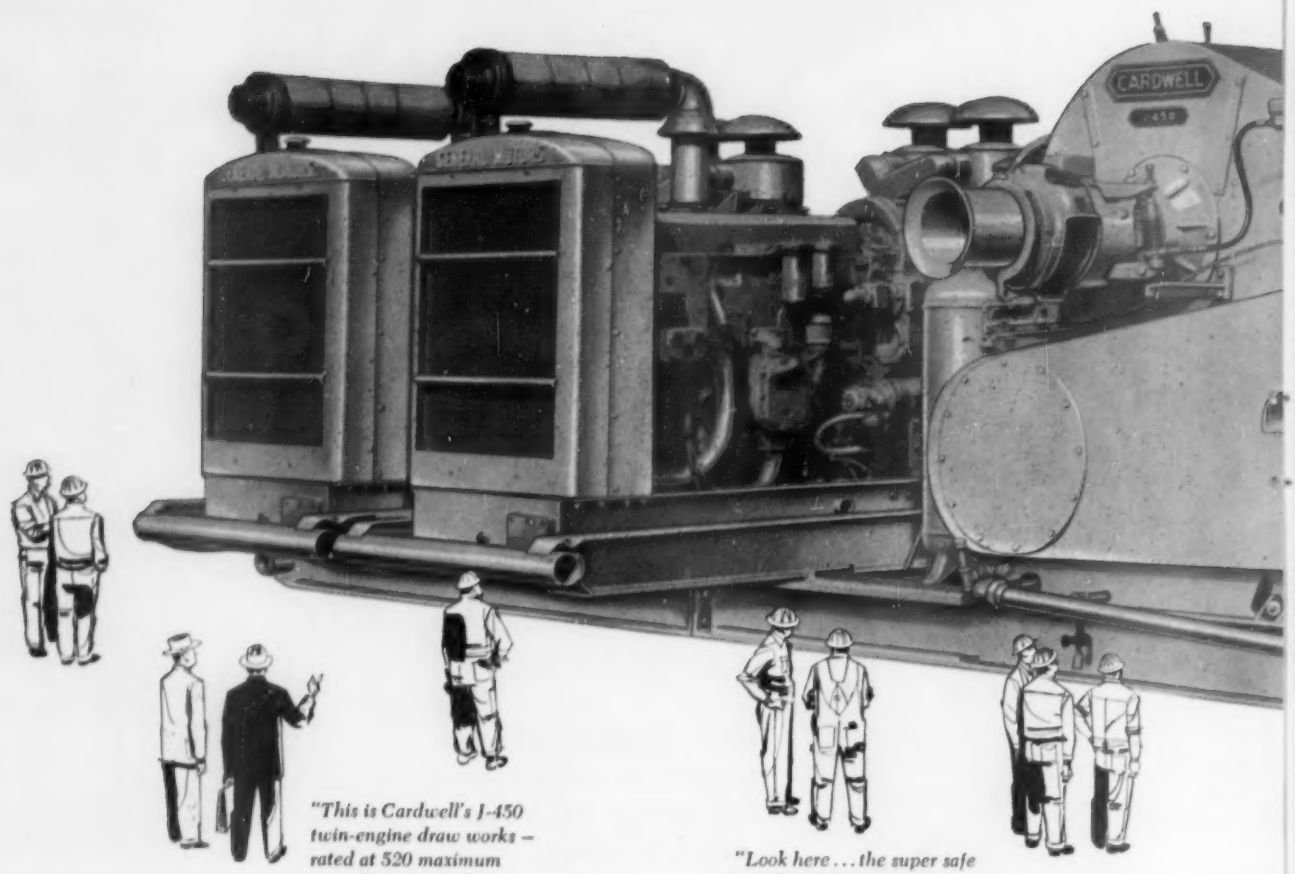

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"Look here . . . the super safe cathead shaft permits slow speeds without idling engines or shifting gears."

. . . "the BIGGEST value in

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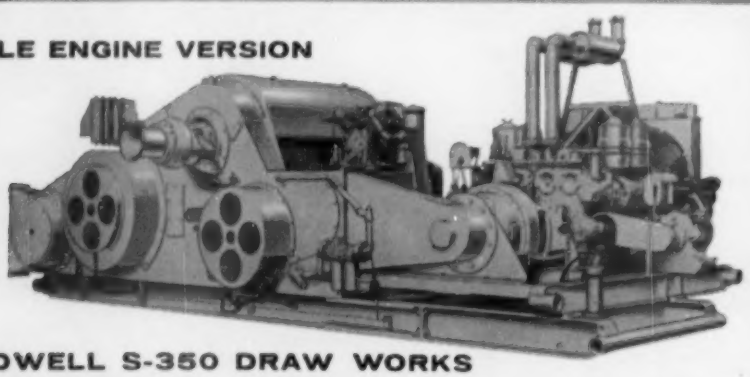

CARDWELL S-350 DRAW WORKS

Features of S-350

- Torque Converter Driven.
- Air Friction Clutch Drive for Main Drum and Cathead Shaft.
- Serves as split rig, if desired.
- Hoist portion identical to Model J-450, and will receive same accessories.
- Maximum Input Horsepower 520.

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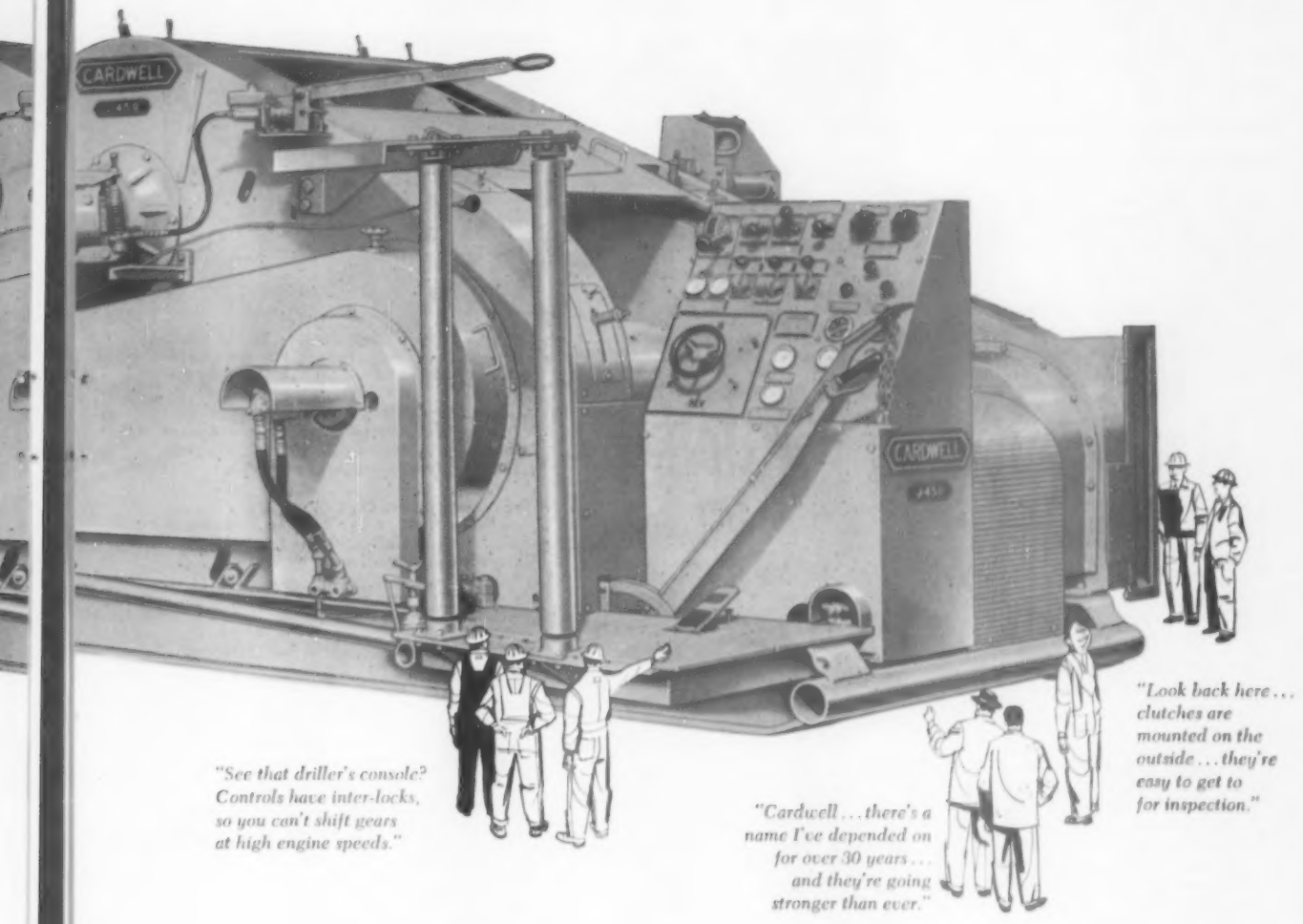

"See that driller's console? Controls have inter-locks, so you can't shift gears at high engine speeds."

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"Look back here . . . clutches are mounted on the outside . . . they're easy to get to for inspection."

DRILLING RIGS today!"

It's a tool pusher's dream . . . and an owner's delight! Your men will like Cardwell's J-450 because of its fast, efficient operation. You will like it because it reduces drilling costs! The advanced engineering in Cardwell's J-450 twin-engine draw works provides you with maximum flexibility and maximum adaptability to barge, trailer, or skid operation.

– And, Cardwell's rigidly exact quality control – the result of more than 30 years' experience – protects your investment, and reduces costly downtime – for years to come. We invite you to "call on Cardwell."

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well completions. All patent rights have been purchased by Otis, and plans are to manufacture, market, and service the gas-lift equipment under the Otis name.

District Sales Managers Appointed by Youngstown

R. P. Broadhurst has been appointed district sales manager of the Chicago district of The Youngstown Sheet & Tube Co.; and C. Hix Jones has been named district sales manager of the Dallas district, succeeding Frank D. Carroll, who is retiring after 40 years of service with the company.

General Sales and Operations Meeting Held by Welex

Fifty-four division managers, assistant division managers, district managers, and department heads of Welex Jet Services, Inc., met in Fort Worth recently for the company's annual general sales and operations meeting.

Ray O. Shaffer, president of the Fort Worth oil-well-servicing company, welcomed the group to the meeting. Jack B. Vaughan, vice president, sales, was moderator.

Reports were given on sales, operations, engineering, accounting procedures, materials and manufacturing, safety, new tools and equipment in design and development, employe benefits, and other phases of Welex business.

More shut-offs per dollar!

Globe or gate, solder cup or threaded . . . you get extra value with NIBCO pressure rated valves. That's because their Nibcoloy stems permit the cutting of accurate long-wearing threads, are high in tensile strength, and are non-corrosive. Then, too, valve bodies are 85-5-5-5 alloy in accordance with A. S. A. standards. In fact, NIBCO valves meet or exceed all performance standards . . . with SWP and WOG pressures clearly marked on side of the body. And they're made by valve specialists — in a plant devoted exclusively to the manufacture of valves.

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NIBCO

PRESSURE RATED VALVES

Bethlehem Supply Promotes and Transfers Personnel

Bethlehem Supply Co. has announced several promotions and changes in location of personnel throughout the organization. R. O. Hall has been transferred to Farmington, N. M., as store manager and field representative. E. S. Edwards has been moved to Borger, Tex., as store manager and field representative. D. A. McCoy has been transferred to Casper, Wyo., as store manager and field representative. H. B. Karstetter has been transferred to Denver and promoted to local representative.

W. A. Nestlerode has been changed to special representative at Denver. L. M. Petrie has been transferred to the Oklahoma City district office and promoted to local representative. Petrie replaces J. A. Buland, Jr., who has been transferred to the Salem, Ill., district office and promoted to special representative.

B. L. Morgan has been transferred from Tulsa to the Oklahoma City district office as machinery sales representative. B. D. Robbins has been transferred from the Tulsa office to the Midland district office as machinery sales representative. J. E. Neighbors has been employed as machinery sales representative in the Tulsa office.

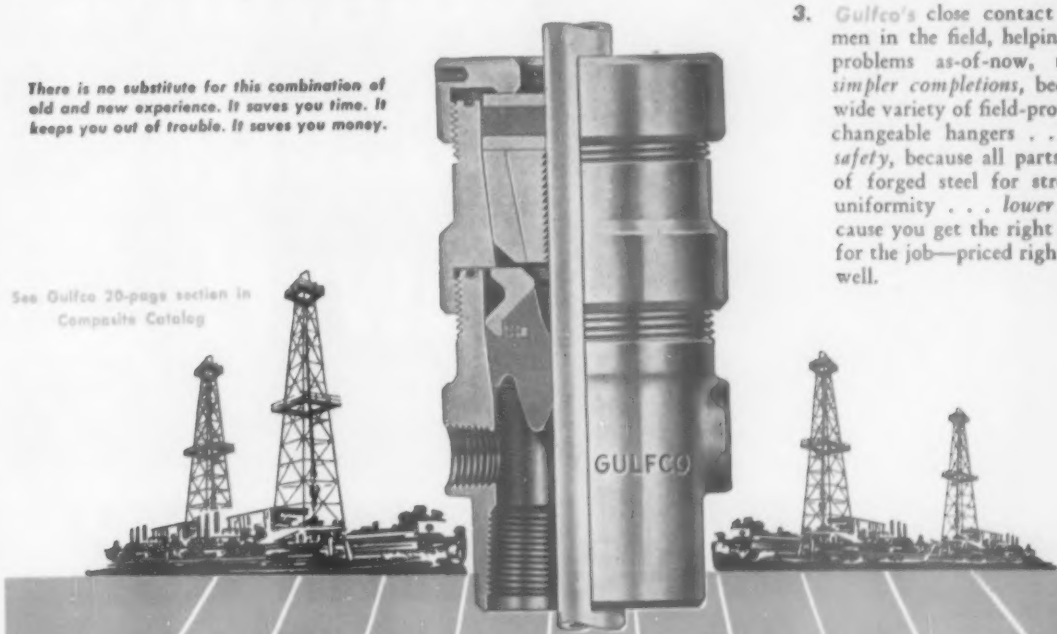
J. K. Davis has been transferred to the Bethlehem Steel Co., Shipbuilding Division, at Beaumont, Tex. He will be replaced as division machinery sales representative at Houston by R. O. Branyon.

When you buy a New Gulfco Head

. . . you get the advantages of the latest, up-to-the-minute Gulfco experience in the field . . . plus . . . the benefits resulting from Gulfco's third-of-a-century of oil industry experience.

1. Gulfco's research and development engineers keep Gulfco products modern.
2. Gulfco's 34 years' oil industry experience, pioneering the use of forged steel and other advancements in both material and methods, keeps Gulfco products safe.
3. Gulfco's close contact with the men in the field, helping to solve problems as-of-now, results in *simpler completions*, because of a wide variety of field-proven, interchangeable hangers . . . *greater safety*, because all parts are made of forged steel for strength and uniformity . . . *lower costs*, because you get the right equipment for the job—priced right for every well.

There is no substitute for this combination of old and new experience. It saves you time. It keeps you out of trouble. It saves you money.



See Gulfco 20-page section in Composite Catalog

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Controlled Fissuring Power!

Welex BEAR GUN

(FORMATION FRACTURING TOOL)

The gun that shoots 'round a corner!

Welex called this mighty innovation the Formation Fracturing Tool when they developed and introduced it two years ago — you, in the field, gave it a new name after using it — the Bear Gun. By any name — oil operators everywhere are calling more and more for the tool's great fissuring power in their tough wells. Wherever the formation or a heavy invasion of mud or cement hinder the flow, call Welex for the Bear Gun. Each shot will give you a large entrance hole — deep into the formation — and the extensive fissuring that reduces pressures and makes your fracturing job a success!

Perforating is no sideline with WELEX!

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East Texas Cracks the Salt Barrier

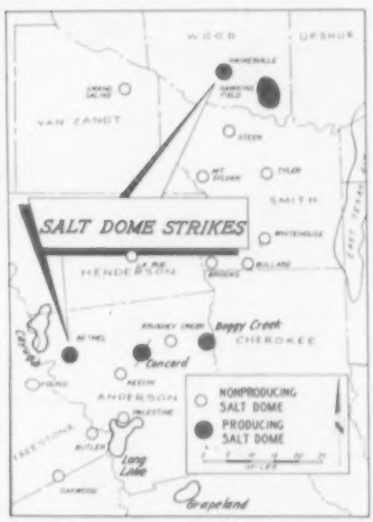
by Frank J. Gardner

A NEST of 18 piercement salt domes in deep East Texas has baffled geologists for 65 years. They were apparently barren of oil, except for one. A second had yielded a bit of production for a short time and gone dry. For years now, they've been written off as a geological liability. Many theories have been advanced to explain their sterility.

But last week, in a one-two punch that made exploration history, theories exploded all over the place, and East Texas was afire with the news. Within less than a week, two of these domes had given up oil from beneath the overhang. This impending debut of two new and important oil fields is the most important event in East Texas oil finding since the discovery of East Texas field in 1930.

Confident operators . . . British-American Oil Producing Co. is drilling a deep hole, the 1 Wisenhunt, on the old Hainesville salt dome, in the deepest part of the East Texas embayment in Wood County. Months of study and expensive seismic work preceded this important wildcat operation. The operators aimed the bit at precise penetration of the salt overhang, so that a maximum number of sands flanking the salt stock might be probed. It was a tedious job, but the information released last week by British-American reflects success. No tests have yet been run, and the well is being carried on down, but the operator is confident enough, on the basis of cores and showings in the Upper Cretaceous section, to describe it as ". . . a significant and possibly a major Woodbine sand discovery."

The first showings found were in the Eagle Ford section, topped at 8,777 ft. Entering the sub-Clarksville at 8,915 ft., the well found three separate tight sands at 8,915-22 ft., 8,940-50 ft., and 9,052-63 ft., with oil showing in the deepest of the three. After topping Woodbine at 9,215 ft., the bit penetrated a 141-ft. interval of broken sands; the electric log reveals that about 85 ft. of this is net potential pay between 9,215 and 9,356 ft. Still lower, a 94-ft. all-sand interval was found, with exact fluid content still unknown; below that, from 9,450 to 9,750 ft., a questionable 300-ft. interval that could be either oil or water-bearing was logged. At the 9,750-ft. level, water sands were tapped, and at this writing, the drill has penetrated to the 10,400-ft. mark on the way to a Paluxy-Lower Cretaceous objective at 12,000 or 12,500 ft.



East Texas reverberated last week to the news of possible major oil discoveries on 2 of its 16 barren salt domes. Only 2 of 18 domes here have ever produced.

With dogged persistence . . . Meanwhile, down in Anderson County on the Bethel dome, The Texas Co. was reported to have recovered 1,000 ft. of oil on a drill-stem test at its 2 Williams. The tested depth was not disclosed, but there's little doubt it was Austin chalk at the 5,600-ft. level. The well is 950 ft. southeast of the 1 Williams, completed dry at 6,255 ft. in November 1955 after it set off a flurry of discovery rumors with reports of oil at 5,636-51 ft. The 2 Williams also penetrated a salt overhang, from 1,550 ft. to 4,500 ft. Operators will carry the hole down to the Buda, expected at 6,200 ft. What they'll find in the Woodbine is yet to be seen. But Texaco is pursuing this salt-dome campaign with dogged persistence, and the ultimate commercialization of Bethel must be assumed.

Crack the salt barrier . . . The real value of these strikes will not be known, of course, until final tests are run. But if those tests result in commercial completions, East Texas will have cracked the salt barrier, and you can expect to see the biggest "me, too" rush since Neches was discovered in 1953. The remaining 14 dry domes will be the magnet for the play, and every one of them will be in for a complete reappraisal via the seismograph.

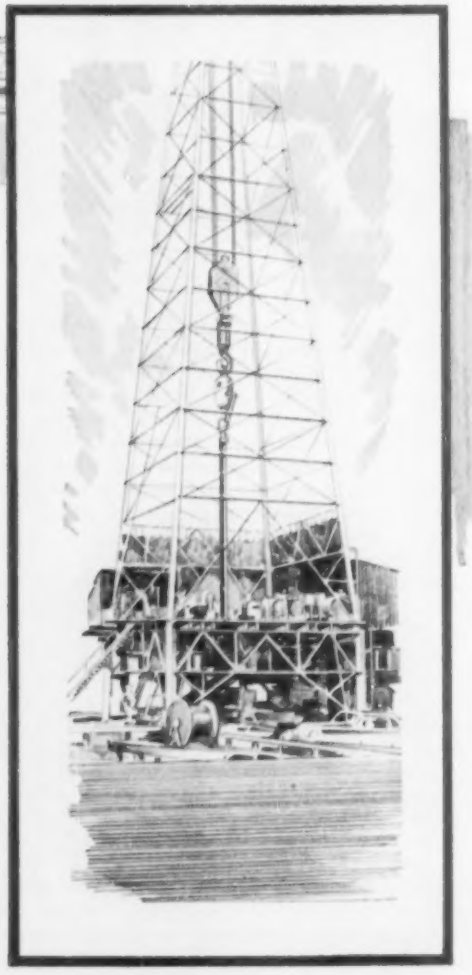
Ever since 1891, when E. T. Dumble first described six of these domes from surface observation, the structures have been a frustrating enigma to oil finders. Eighteen of them have been found to date, and only two have produced oil in commercial quantity—these were Boggy Creek and Concord (now abandoned). Showings have been found on some of the other 16, but no fields have developed. When Humble Oil & Refining Co. brought in the discovery well at Boggy Creek in 1927, seismic crews swarmed all over the piny woods country looking for salt domes. They found them. They were real textbook piercement salt domes. At Palestine, the salt was only 120 ft. below the surface; at Concord it was 6,000 ft. under. Here are 18 challenges to the drill. But except for Boggy Creek, they remain challenges today.

Out of the vast amount of study that has been directed at these structures, some basic conclusions emerged. Three of these, which have appeared in various papers and publications, are heavy with meaning: (1) flank structure on these domes is likely to be much more complex than was previously supposed; (2) our subsurface study is probably inadequate in the light of today's new knowledge and tools; and (3) perhaps an entirely new approach is needed on these inland domes.

With a new approach . . . British-American and Texaco have employed the new approach, and with apparent success. Isn't it time that the geophysicist was given a crack at reworking every one of these salt domes in the light of his new knowledge and tools? If these two wildcats come in, you can rest assured he will be.

There are 2 kinds of Macaroni

This kind



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Unit Approach

1. Saves real money
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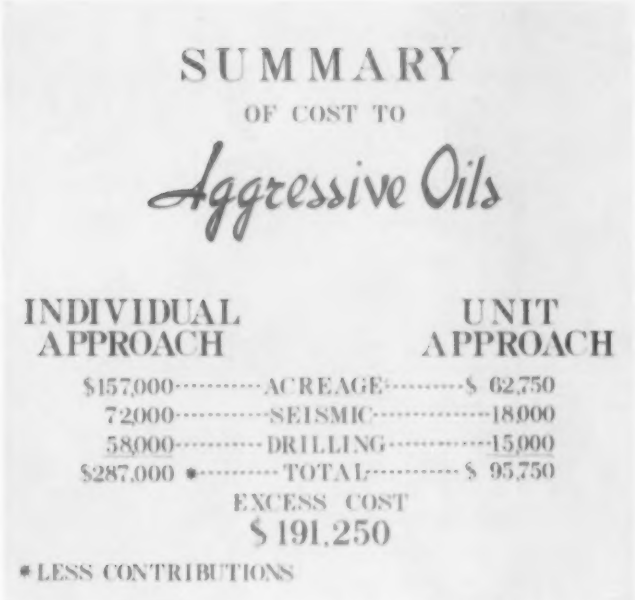
. . . this new Model Form Operating Agreement streamlines the necessary procedures



Joint exploration is one answer to cut the rising cost of finding new oil in many areas of the country. Here the Unit Approach would have saved Aggressive Oil Co. $191,250.

by John H. Folks

JOINT exploration programs offer oil companies a real opportunity to save money and to process acreage rapidly. The new Model Form Operating Agreement simplifies the various problems that normally come up when a joint exploration program is undertaken. Here is a typical, although hypothetical, account of the problems involved in a joint exploration program.

The Unit Approach would have saved Aggressive Oil Co. $191,250. All the companies in the area of interest (Fig. 1) benefited from the $287,000 spent by Aggressive in acquiring and processing its acreage. But only one company contributed to the venture and its contribution amounted to less than 1 per cent of the total cash outlay.

The purpose of this hypothetical example is to cover the ideal in unitization of effort and to dwell briefly on some of the difficulties that frequently prevent its accomplishment. Administrative difficulties and argument over controversial issues are depriving the industry of the benefits to be gained through joint effort.

Attempted formation of the "area of interest" . . . Fig. 1 outlines an area of 28,160 acres, a quadrangle of land 4 by 11 miles. Geologists suspect a major fault, but the extent of its scope and the amount of relief along it must be determined. Aggressive Oil desires to explore with seismograph in this high-cost problem area. The survey will require about 80 miles of lines in order to learn more concerning the fault. Estimated time required is 4 months and an expenditure of from $50,000 to $80,000.

An acreage analysis reveals diverse ownership. Aggressive Oil would like to arbitrarily agree with the other owners that upon completion of joint seismic effort, it will be permitted to acquire 25 per cent in all desired acquisitions. Acreage in this area costs $25 per acre. To obtain a 25 per cent ownership in the proposed area of interest will cost $176,000. The expenditure of this sum by Aggressive prior to confirmation of the fault and necessary relief is extremely distasteful and in all probability wasteful. Aggressive feels that to call a unit meeting without some ownership is much too hazardous and decides that the cost of acreage to assure participation practically precludes proceeding with the joint idea.

If the shooting confirms the fault, Aggressive Oil intends to project the fault and to buy acreage in which relief is demonstrated. Because of normal selfishness, Aggressive desires to preclude participation by the other proposed area of interest owners in these possible future acquisitions because the new leases will be outside the outlined area of interest.

Aggressive decides to feel out Good Co. prior to a formal meeting. Because the solid holdings of Good Co. were acquired on subsurface ideas, Good, when approached, refuses to enter an area of interest which will cause it to spread these holdings. Any future operating agreement must be limited to a specific anomaly and only those owning thereon will participate. This creates no assurance of participation by companies that have only solidified concentrations.

For these reasons, Aggressive Oil is forced to abandon its thought of a large cooperative exploration program. This program would begin with seismic work and equitably distribute the future expense. And it would prevent duplication in seismic effort by other companies which are members of the joint program.

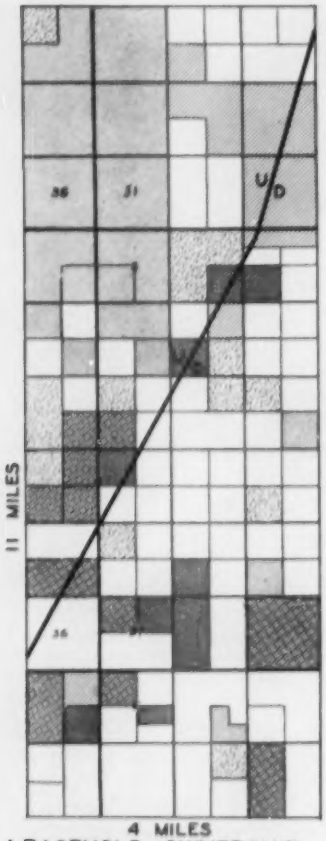
Aggressive Oil carried out the seismic program at a cost of $72,000. On the strength of the shootings (Fig. 2), Aggressive acquired 5,920 acres of leases at a cost of $157,000. These acquisitions were made when evidence of the fault was first confirmed and prior to completion of detailed seismic work; in other words, a wasteful expenditude incurred in self-defense because the area was so "hot."

The Unit Meeting

Aggressive Oil then proposes a unit (Fig. 3) and calls a meeting of the companies involved. All partners are requested to send geophysical, geological, and land representatives to the meeting to review Aggressive's data.

This $72,000 review is absolutely gratuitous without any assurance that

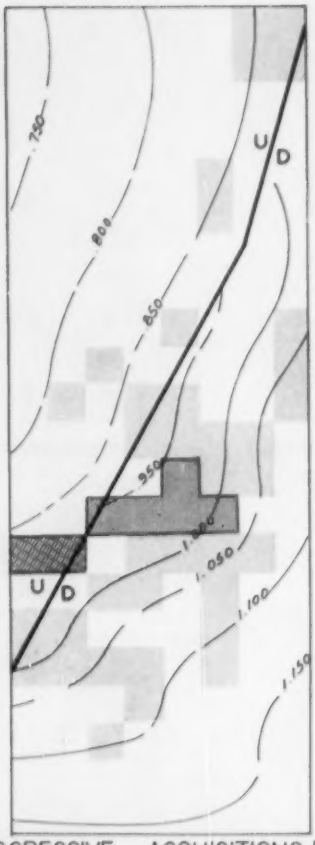
Author is division land man, Carter Oil Co., Oklahoma City. Paper from Mid-Continent meeting of Society of Exploration Geophysicists, Fort Worth. Presented here by special permission of the S.E.G.



LEASEHOLD OWNERSHIP

COMPANY	ACRES	PER CENT
HOBO	2,720	9.66
P&P. OIL	2,160	7.68
PHILCO	2,240	7.96
GOOD	5,720	20.31
KEEN	2,340	8.30
OPEN	12,980	46.09
TOTAL	28,160	100.00

BECAUSE of the diverse ownership, Aggressive Oil Co. wants to form a unit that will explore the area of interest. This exploration unit will benefit all leaseholders and each will pay his proportionate share of the costs. Fig. 1.

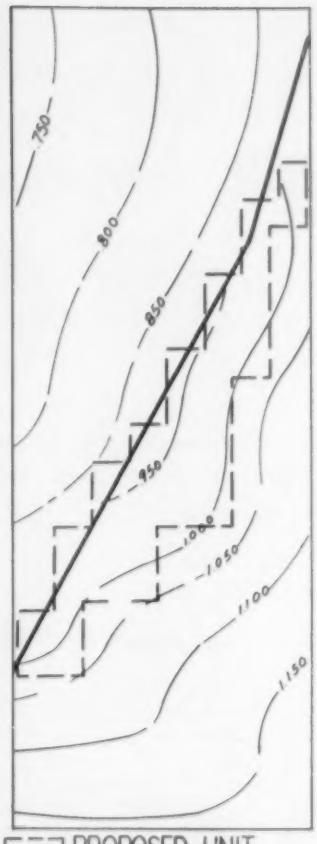


AGGRESSIVE ACQUISITIONS

	ACRES	PER CENT
$ 157,000.00	5,920	21.00

HOBO
KEEN

AGGRESSIVE carried out the seismic program and bought leases on the strength of the preliminary shooting that confirmed the fault. Fig. 2.



PROPOSED UNIT

COMPANY	ACRES	PER CENT
HOBO	1,440	26.48
P&P. OIL	480	8.83
PHILCO	800	14.71
KEEN	320	5.89
AGGRESSIVE	1,920	35.30
OPEN	420	8.83
TOTAL	5,440	100.00

AGGRESSIVE proposes a unit based upon its shooting. Each company's share in the unit is based upon its acreage. Fig. 3.

a unit can be formed. At the unit meeting several objections are raised:

● Keen demands that regional credit be considered and that more of its acreage to the west be included. It feels that too much value is placed on the seismic data and particularly the effect of any fault that may exist.

● Hobo will not contribute long-term leases for those to which there is serious doubt that normal developments will exploit before expiration; neither will it allow a contractural arrangement that may result in having to expend money to renew such leases or to engage in stepout drilling. Philco is required to renew its leases or be excluded.

● P. & P.'s management doesn't care for the area. Therefore, it desires to contribute to the other partners an undivided half interest in its leases and be carried to tanks in the first well, or to contribute a nominal amount of dry-hole money.

● Specific objections as follows are raised in connection with the operating agreement:

Examination of titles . . . Aggressive Oil desires to send its title papers, abstracts, curative material, attorneys' opinions, evidence of rental payments, etc., to the second-largest owner for examination. Aggressive will examine all titles of other companies. One company desires that the examining companies bear all the expense. The examining companies feel that the attorneys' fees connected with examination should be borne by all. One company will not accept the examination of any other and demands that it be permitted to examine all titles and, therefore, be excluded from any joint expense.

Loss of title . . . Hobo Co. agrees to join provided any loss of any lease because of title failure is the loss of all. Aggressive will not agree to a joint loss but feels that the company contributing the bad title shall bear all the loss. The amount of loss in terms of dollars becomes the subject argument. Must the losing party make up for profit that would have been made on the lost tract? Is the company that loses the tract responsible to the others for back runs? If not, does it lose runs from the date title is questioned; from adverse decree in the lower court, or from final decree in appellate court, a matter of years sometimes?

If another owner becomes possessed

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here's why

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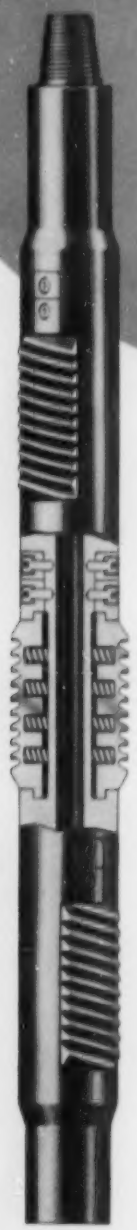

Casing Scraper

CHANCES ARE, *any* string of casing you run, cement or perforate is a string that *must be clean* before you set packers, run swabs or perform any other completion work on new wells or old.

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of the last tract and by involuntary spacing is brought into a producing unit and thereby is forced to pay for his proportionate part of the well, to whom does his payment go? If the tract containing the well is lost and no reimbursement is had, does the original contributor of the tract reimburse the other coowners for what they had in the well?

Drilling additional wells . . . Hobo Co. wants to set up an "operator's committee" with a provision that the vote of a majority shall bind all for any desired additional development. This will permit Hobo Co. and Aggressive to have complete and absolute control. Keen Co. does not have adequate assets to back such unlimited authorization; it desires the right to step out of any 40-acre drill site that it does not desire drilled.

Philco is not agreeable to either the committee or the stepout system and insists upon insertion of 150 per cent penalty provision. P. & P. Co. advises that it will not make a normal investment of 50 cents on the dollar and it certainly will not agree to one which by its very nature is more hazardous than normal for less than $1 per $1. It insists upon a penalty provision of 200 per cent. Hobo is agreeable to either penalty provision but feels it should apply to the running of pipe in the initial well as well as subsequent operations.

Aggressive wants the right to run pipe without consulting the partners as a part of normal operations. Aggressive insists that any penalty which is agreed upon apply to initial drilling in any well only; while Hobo wants it to apply to all future deepening, reworking, or plugging-back operations. If the penalty provision is adopted and as a result fewer than all the parties drill a well to a given announced objective to which some of the parties decline in joining, shall the declining parties be deprived at a later date from participating in deepening the well. If they are not so deprived, shall they be entitled to the fruits of such deepening without making reimbursement to the original drilling parties; on this there is divided opinion.

Insurance . . . Keen, being a small company desires to be covered by commercial insurance for all risk. It will only execute an agreement which so provides. Aggressive is a large "major" and wants to carry its own risk. Keen suggests that Aggressive carry all risk and charge Keen only a commercial premium. Aggressive's attorneys contend that by so doing Aggressive is engaging in the insurance business for which Aggressive has no charter. Aggressive overcomes this objection by reluctantly agreeing to bear all of Keen's risk provided that if a loss is incurred Keen shall reimburse Aggressive an amount equal to the cost of premiums had commercial insurance been carried.

Limitation as to rights . . . P. & P. contends that the unit is being formed for development of the Joe limestone and that all other formations should not be affected by the unit agreement. Hobo feels that the unit is being formed for the production of gas and that the oil rights should not be affected. It proposes that should the well be completed as a producer of oil that the company on whose lease such well is drilled shall become the owner and reimburse the unit for all expense. Aggressive will unitize only if all rights and formations are subject to the unit.

Termination . . . Hobo desires the unit to terminate ipso facto if the well be completed as a dry hole. Keen wants the unit to remain in effect for a period of 6 months from completion of the test and so long thereafter as not more than 6 months elapse between completion and commencement of wells. Philco will join only if the agreement lasts the life of the leases (its object is, of course, to trade short term for long term leases).

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Here are the points covered by the new Model Form Operating Agreement. This is the result of 3 years' efforts by an industry committee and is now available to oil companies. Fig. 4.

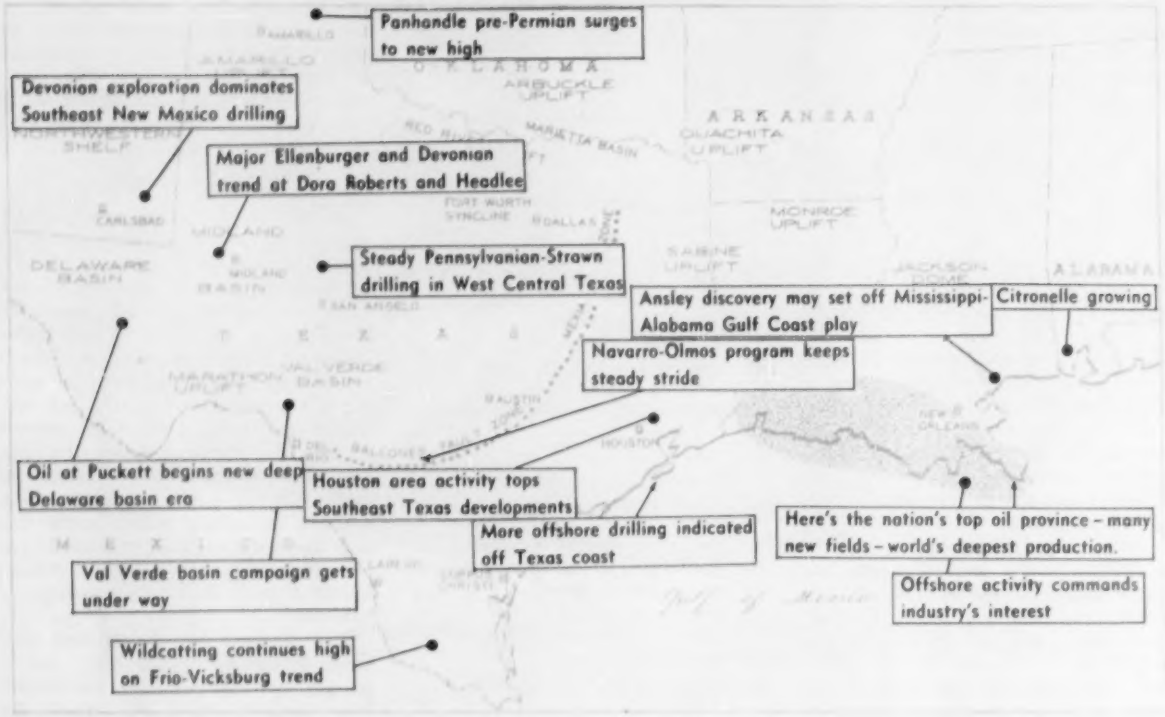
Summary of Effort

At the end of this harrangue, Aggressive decides that the formation of a unit is probably impossible. There is no alternative but to approach the adjacent owners for dry-hole money in support of a test to be located in the center of Section 17. Since the area is intended primarily for gas, the spacing is a governmental section per well. Aggressive approaches all the owners in the eight offsetting sections for support. One company after another reports that the policy of its company requires an offset before supporting and that its acreage is not considered an offset. Aggressive finally obtains $2,000 from P. & P. of an anticipated $18,000.

Had the area of interest been possible, Aggressive would have had a 25 per cent participation and would have acquired only 1,360 acres in the unit and 1,150 outside for a bonus cost of $62,750. The remainder of the acquisition would have been absorbed by other unit partners. Aggressive would have borne $18,000 of the $72,000 seismic expense and $15,000 of the $60,000 that was required to drill a 6,000-ft. dry hole. The inability to effect the unitized program created an inequity in which the company with the original idea bore $191,250 that it would not have expended. Except for the value of the additional acreage, some 10 per cent, all of this excess expenditure was for the benefit of the other companies. And they contributed a total of only $2,000 in the form of dry-hole commitments!

Model Form Operating Agreement

Now there is a bright side to this gloomy picture. For 3 years an industry committee has been working on a Model Form Operating Agreement which is now available to the industry. All of the controversial issues raised in the unit meeting which was called by Aggressive have been covered and resolved in an equitable manner. Many companies have contributed effort to this project, and though none is committed to use the form there is hope that: (1) All will realize that there must be much giving and taking in arriving at an agreement for a unit venture, and (2) this model agreement will prevent to a large extent the kind of wrangling which Aggressive experienced in its effort to form a fair and just arrangement.


Panhandle pre-Permian surges to new high
Devonian exploration dominates Southeast New Mexico drilling
Major Ellenburger and Devonian trend at Dora Roberts and Headlee
Steady Pennsylvanian-Strawn drilling in West Central Texas
Ansley discovery may set off Mississippi-Alabama Gulf Coast play
Citronelle growing
Navarro-Olmos program keeps steady stride
Oil at Puckett begins new deep Delaware basin era
Houston area activity tops Southeast Texas developments
More offshore drilling indicated off Texas coast
Here's the nation's top oil province – many new fields – world's deepest production.
Offshore activity commands industry's interest
Val Verde basin campaign gets under way
Wildcatting continues high on Frio-Vicksburg trend

Texas and Louisiana Count Successes

. . . and look confidently ahead

by John C. McCaslin

EXPLORATION history is being written along the Gulf Coast waters of Louisiana, in the inland swamps of the Mississippi River Delta region, in the mesquite country of Southwest Texas, near the metropolis of Houston, and in the Panhandle and South Plains of Texas.

A quick rundown on first-half 1956 exploration in this vast region reveals some of the most significant discoveries of the past decade for Texas and in the Gulf Coast. The world's deepest hole and the globe's deepest oil production were established in South Louisiana. Deep trends are topping West Texas and New Mexico exploratory efforts, while steady development along known trends in South and Southwest Texas continues.

South Louisiana

The deepest hole . . . The most significant exploratory story of the times came out of the marshes of Plaquemines Parish, South Louisiana, in April.

Not only did Richardson & Bass et al. put down the world's deepest hole, but they established the world's deepest oil production in the same well. The 1-L Humble L.L.&E. flowed 134 bbl. of 38°-gravity oil daily on 7/64-in. choke from Miocene sands at the uncanny depth of 21,443-65 and 21,419-35 ft., adding 3,500 ft. to the old producing-depth record set at Coles Levee in California. Total depth of the Louisiana well is 22,570 ft., another prize winner.

. . . Success reigns. Louisiana, the nation's most successful oil province, has been in a commanding lead in 1956 drilling activity. New fields, new pays, and extensions have kept the map watchers and plotters extraordinarily busy. Offshore development and exploration is reaching its peak as the last half of 1956 nears. There are no signs of any letup in either onshore or offshore drilling for some time to come. As of the last of May, 17 new pays, extensions, and discoveries were put on the books offshore from South Louisiana; onshore, 65 new oil, gas, or distillate new-field, new-pay, or extension discoveries.

The Texas Story

Exploratory success in Texas this year is far flung. Both the old and the new vie for commanding exploratory interest. Exploration is brisk in and around older producing areas, but there is a definite accent on the deep and remote throughout the southwestern, western and Panhandle regions.

West Texas-New Mexico . . . Deep exploration in this province is scattered over the entire western portion, with Devonian rocks the main goal. This deep development runs the entire north-south length of the Central Basin platform, along the eastern border, and as far north as Cochran County on the Northern Basin platform.

Excellent Devonian wells are being brought in along the eastern state border of New Mexico, north of the Cen-

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The **conventional** blasting cap used in Jet Perforating Guns has always been a source of danger to life, wells and other property . . . because it requires only about 1/10 of a watt of electrical energy to detonate the cap and thereby accidentally fire the whole gun. This inherent weakness of the **conventional** blasting cap was determined years ago by PGAC engineers when they discovered that such infinitely small amounts of electrical energy could be picked up by the firing circuit from stray currents or from discharges of static electricity around or within the well.

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PGAC engineers finally devised a completely new blasting cap assembly, combining a high-resistance element and a fuse in the circuit. PGAC's new cap cannot be detonated until after its fuse is burned away — and the fuse cannot be burned away by other than a **relatively high current.** Such current cannot be picked up accidently by the circuit — but must be introduced **by the simultaneous closing of two electrical circuits** which, in turn, can be accomplished only by two hands simultaneously and intentionally operating two separate switches on the control panel.

INVENTION PATENTED

All features of this new blasting cap assembly and its unique firing circuit have been fully protected by United States Patent No. 2,703,053 granted to the Perforating Guns Atlas Corporation. The new blasting cap assemblies and firing circuits have been exhaustively field-tested for several years and found as foolproof as humanly possible.

A CONTRIBUTION FOR SAFETY

In the interest of **Increased Safety** for the entire Jet Process Perforating Industry, PGAC has made available to **all** present and future licensees having the right to use the Jet Process, the additional right to use this new PGAC invention **without the payment of royalty of any kind.**

USE INVITED

It is sincerely hoped by PGAC that their confreres of the Jet Perforating Industry will avail themselves of this contribution to **the Greater Safety of their personnel and their customers' property.** No other reward could be so gratifying to the men and women of PGAC.

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tral Basin platform, from Knowles field to Gladiola. These discoveries have resulted in considerable deep prospecting. At this writing there are half a dozen wells drilling on Devonian contracts along Lea County's northwestern side, east of Bagley field and north of Caprock.

. . . Delaware basin. Deep Pennsylvanian and Devonian discoveries at Puckett gas field in this remote and vast basin of far West Texas are lighting the way for an intensified deep oil hunt. Gulf Oil Corp. provided the spark at its 1-A Robbins Gas Unit, uncovering the first Pennsylvanian oil pool on the large Puckett anticline in Pecos County, 20 miles from nearest oil production at Taylor-Link field. Later a Devonian discovery shook the dust off Delaware basin exploration.

Val Verde basin . . . New drilling interest is stirring in the Val Verde basin, a four-field province. Vinegarone field is the only producing area having more than one well.

Magnolia Petroleum Co. got the 1956 campaign into gear in a wild area of little-explored Val Verde County. The 1 Morrison flowed gas from the Ellenburger at 13,944-14,062 ft. This is the first Ellenburger production in the county, and the well is also the southernmost Ellenburger producing area.

Southwest Texas . . . Developments along the Frio-Vicksburg trend plus the continued active Navarro-Olmos sand play on southwestern extension of the Balcones fault zone are the exploratory highlights of drilling in south and southwestern Texas.

South Texas . . . The Houston area is one of the hottest drilling spots in Texas this year. A big surge in Pierce Junction field development features drilling in this region.

West Central Texas . . . There is a decided increase in Pennsylvanian Strawn exploration and subsequent development throughout the Tom Green, Coke, and Nolan counties area.

Texas Panhandle . . . The pre-Permian oil and gas search in the northeastern counties of the Texas Panhandle is at its highest pitch. This development has marched right across the top tier of counties east of Hugoton field from Hansford to Ochiltree, and on into Lipscomb County in the past 2 years. The focal point of the search now centers in Ochiltree County. This Texas Panhandle exploration is only part of a four-state campaign which covers the Oklahoma and Texas panhandles, southwestern Kansas, and southeastern Colorado.

EXPLORATION HIGHLIGHTS

APPALACHIAN

WEST VIRGINIA

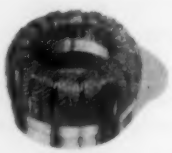
In Greenbank district, Pocahontas County, West Virginia, Colombian Carbon Co. 1220 U.S.A. wildcat, elevation 3,222 ft., is dry at 3,300 ft., and is reported as being plugged.

● Licking district, Tucker County, Hope Natural Gas Co. 9985 J. H. Ludwick, elevation 1,710 ft., is drilling at 3,937 ft. The Onondaga was recorded at 3,721 ft., Marcellus shale at 3,757 ft., a second section of Onondaga at 3,805 ft., and the chert at 3,831 ft.

PENNSYLVANIA

Armstrong Township, Indiana County, Southwest Pennsylvania, Columbian Carbon Co. 1833 Susie Yosurack, shut down at 1,771 ft. to move in rotary outfit.

"Okay—now toss me some . . . let's see now, NITROGLYCERIN . . . whatever that fool stuff is."



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• In Young Township, Manufacturers Light & Heat Co. 4336 G. L. Stewart, is drilling at 7,134 ft.

• Mount Pleasant Township, Westmoreland County, Peoples Natural Gas Co. 4092 J. G. Mailey, ran casing at 990 ft., cemented and shut down.

OHIO

A new pool or an extension ½ mile south of Blissfield and 1 mile north of Bethlehem, was found by Preston Oil Co. on 1 Ida Fabian, Section 25, Clark Township, Coshocton County. Clinton sand at 3,451-3,522 ft. gaged 79 bbl. in a 24-hour test.

• Belden and Blake moved west into Granger Township, Medina County, and brought in a nice well on 1 R. K. Carr, Lot 80. Clinton was found at 3,492-3,546 ft. and gaged 625,000 cu. ft. gas and 100 bbl. of oil in 24 hours after fracturing.

• A ⅔-mile south extension to production in Hopewell Township, Muskingum County, was completed by Central Ohio Oil Co. on 1 Ellis Robison, Lot 34. A good showing natural in Clinton at 3,106-52 ft. increased to 160 bbl. daily after fracturing.

SOUTHEASTERN STATES

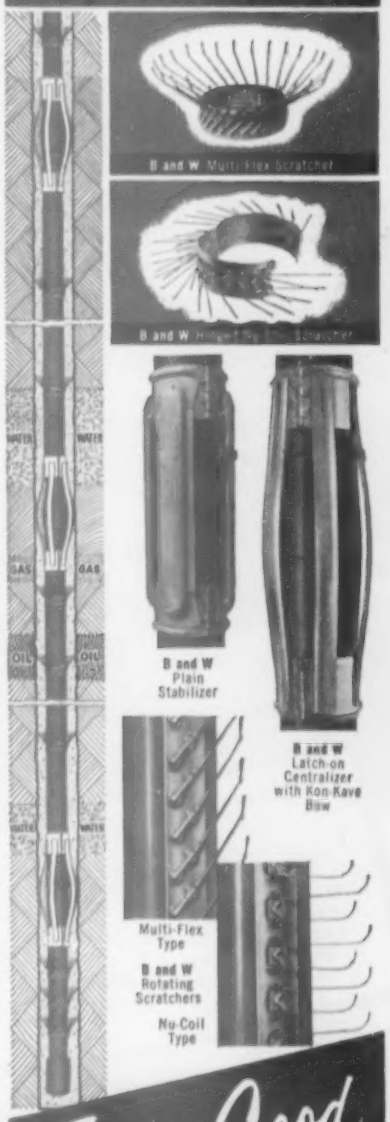
MISSISSIPPI

Dual Gas Well Finaled Southwest of Pistol Ridge

David Crow, Trustee, et al completed a dual gas-condensate discovery at 1 Crosby Forest Products Co. et al in C SE NW SE 8-1s-14w, 1¾ miles southwest of Pistol Ridge field, Pearl River County.

The deepest zone of the two-zone producer is the Washita - Fredericksburg of Lower Cretaceous age. Perforations were at 9,967-73 ft. Calculated open flow was 10,000 M.c.f. of gas per day plus an estimated 19 bbl. of condensate per million.

B and W
SCRATCHERS AND CENTRALIZERS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Width and length dimensions are also unusually compact, saving valuable cellar space in all three dimensions.

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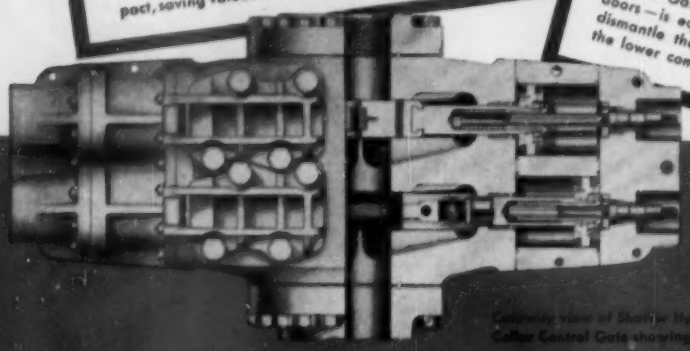
Shaffer's patented side-opening doors provide unmatched simplicity in servicing rams. Simply unbolt and open the doors—change rams—and bolt the doors shut again. Closing the doors automatically aligns the rams within the gate.

And in Shaffer Hydraulic Double Gates, each compartment has its own set of doors—is equally easy to service. There's no need to dismantle the upper compartment to change rams in the lower compartment—or vice versa.



Cutaway view of Shaffer Hydraulic Double Cellar Control Gate showing simple design.

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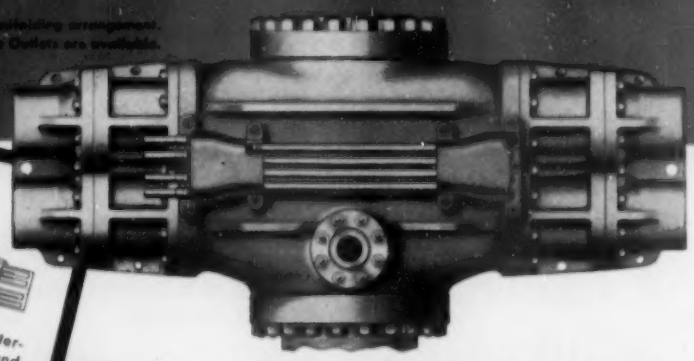

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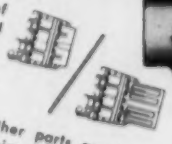

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This is the drilling picture of northern Lea County; a new high in deep prospecting.

Haskins & Knickerbocker 1 Lane Ranch. Robinson Bros. rig.

Deep Drilling Shifts to North in Lea County

by Carl Hoot

HOBBS.—The search for deep oil-bearing rocks has moved northward, and out of the "trend" area—running from Knowles to Gladiola field on the east-central side of Lea County. Operations now are spread over the entire northern portion of Lea County, in the Northwestern Shelf area.

The 16 stars on the accompanying map represent active wildcats, with contract depths to 12,000 ft. or more. In most areas this depth will test the Devonian. As the map also shows, exploration is moving inward toward the buried sea channel area between the two parallel trends on either side of Lea County.

Production moving inward . . . Humble Oil & Refining Co. 1 South Four Lakes Unit, a recent Pennsylvanian discovery, has moved production toward this central, undeveloped area. Location is about 10 miles west of Tatum. Humble's test was carried to 12,222 ft., then plugged back to pay at 10,227 ft. Initial potential was 304 bbl. a day through small size choke, although the well flowed as high as 389 bbl. of oil in 12 hours on tests. It also flowed oil on drill-stem tests of the Wolfcamp. Bagley and Hightower fields, to the west of the discovery, have Pennsylvanian and Siluro-Devonian production.

Northern areas promising . . . Principal interest for wildcatters seems to lie in the area north of Tatum. A number of these deep tests have had oil shows, and several are nearing contract depth.

New gas well . . . Sunray Mid-Continent Oil Co. 1-K State, in the northwestern corner of Lea County, has been completed as a small Pennsylvanian gas discovery. Drill-stem tests flowed gas and recovered distillate from Atoka sand between 10,140-10,218 ft., with bottom-hole flowing pressure ranging upwards of 1,700 psi. on ½-in. choke. Hole was drilled ahead to 10,775 ft., then plugged back for completion from perforations at 10,184-195 ft. Calculated open-flow potential was 3,750 M.c.f. of gas.

South of Cross Roads . . . Texas Pacific Coal & Oil Co. 1-0 State opened a Devonian oil pool in the northeastern corner of Lea County, 4 miles south of Cross Roads. Initial potential was 321 bbl. of oil a day through small choke, from open hole at 12,269-87 ft.

D. D. Feldman 1 State, 10 miles southeast of Texas Pacific's discovery, found the Devonian dry in drilling to 12,218 ft., but plugged back to make a Wolfcamp well. Potential was 88 bbl. a day through ⅜-in. choke, from pay at 9,466 ft. Location is east of Echol-Devonian field.

Into the trend area . . . Ralph Lowe 1 Wallace opened a flush Devonian pool north of Gladiola, along the eastern Lea County border. Completion potential here was a whopping 2,640 bbl. of 46° oil a day through ¾-in. choke. Pay was from 11,990-12,046 ft.

At approximately the same time, Cabot Carbon Co. 1 Fleet found flush Devonian oil southwest of King-Wolfcamp pool. No. 1 Fleet rated 1,000 bbl. of oil a day, from pay at 12,439-54 ft.

Exploration step-out drilling has added big Devonian wells to the South Denton area, 12 miles east of Lovington and a mile or so north of State Highway 83. Signal Oil & Gas Co. 1 Kelly-State, a northwest extension, flowed 1,944 bbl. of oil a day through ⅛-in. choke. Signal's west extension to this same area flowed 1,624 bbl. of oil a day from the Devonian.

Deep oil in Caprock Trend . . . Exploration has paid off with a Devonian discovery along the western side of Lea County, between the Lazy "J" Pennsylvanian fields and shallow produtcion in the Caprock Trend.

This latest Devonian discovery completion is U. S. Smelting, Refining & Mining Co. 1 Superior-State, which drilled into the Devonian around 12,314 ft. On final test the well made 429 bbl. of 48° oil a day through 20/64-in. choke from perforations at 12,338-44 ft.

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HUGOTON EMBAYMENT

NORTHWEST OKLAHOMA

Hoover Sand Pay Proved At Harper County Well

Gas production from the Hoover sand has been proved at Sunray Mid-Continent Oil Co.'s link well between East and Southeast Laverne fields, Harper County.

The 1 Stinson, NW NW SE 34-26n-25w, flowed 6,200 M.c.f. of gas per day on 12-minute drill-stem test at 4,223-51 ft. in the Hoover sand-Pennsylvanian.

Southwest Stockholm . . . Oil Capitol Corp. has a Tonkawa - Pennsylvanian gas well at 1 Zoldoske, C NE SE 14-26n-24w, at 5,547-70 ft. The well flowed an estimated 10,000 M.c.f. per day from the Tonkawa, which is the field's regular pay zone. Recovery was 30 ft. of distillate on drill-stem test in the lower Tonkawa.

ARK-LA-TEX

NORTH LOUISIANA

Linkup Seen at Red Rock-North Shongaloo

It appears that Red Rock and North Shongaloo fields in Webster Parish will be connected as a result of a Hunt Oil Co. well, the 1 H. L. Haynes et al Unit in 18-23n-9w.

Tokio sand production is indicated from wells in both fields, and a deep Smackover test on the west flank of Red Rock field may extend that production into North Shongaloo. Hunt is drilling below 7,469 ft. to the Smackover at 10,400 ft., after having found production in the Tokio zone on drill-stem test at 3,038-65 ft. Just northwest of this well ¾ mile is Crow 1 Haynes, NW NW NW 18-23n-9w, a Tokio producer completed last year. Hunt is making production tests of 6 ft. of Tokio sand pay at the 1 A. C. Burns in SE SW SW 7-23n-9w, the northeast diagonal offset to the Crow well.

MAY DISCOVERIES

Exploration in North Louisiana in May netted one new field and two new pays. The new field is a rediscovery of the old one-well St. Joseph field in Tensas Parish, while the new pays were in Homer field, Claiborne Parish.

Gulf Refining Co. reopened production in St. Joseph field, Tensas Parish, at 1 Curry-Brown Unit, 41-11n-12e, 2¼ miles northeast of Locust Ridge field. The well flowed at the

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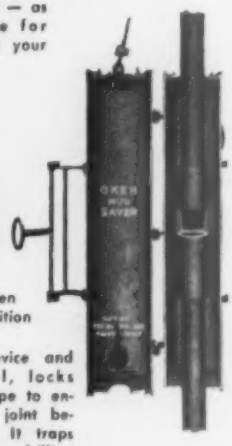

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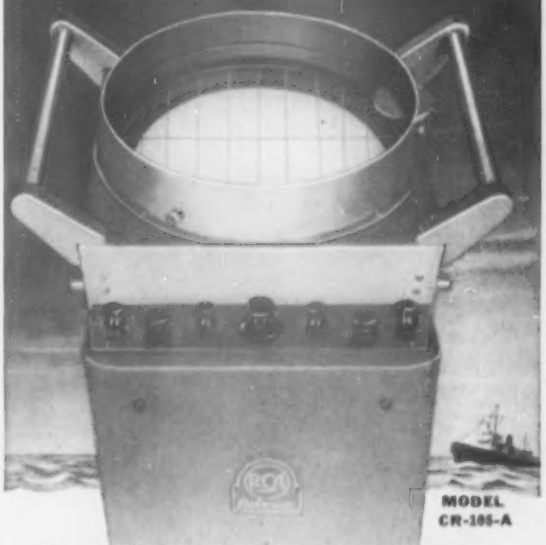

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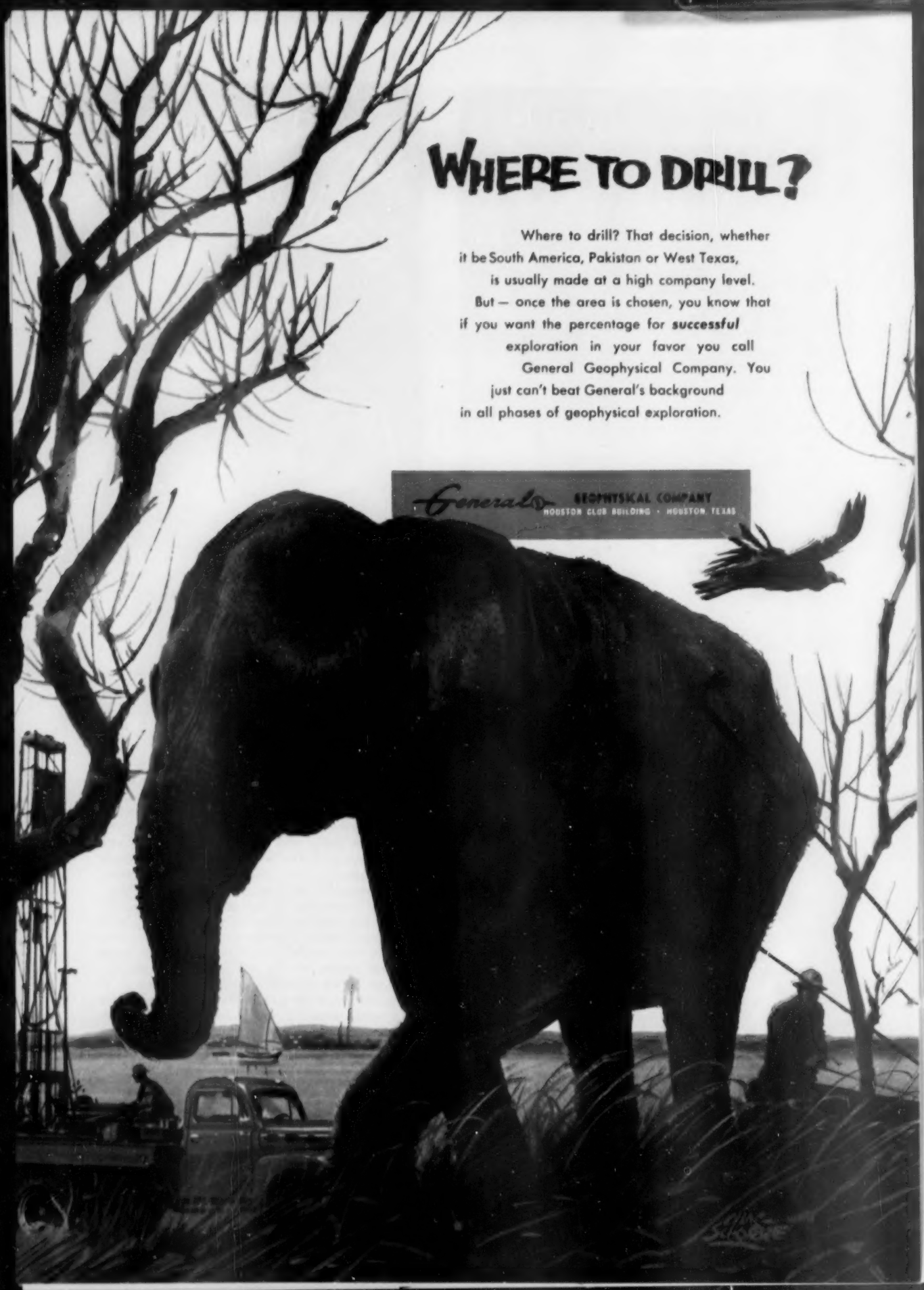
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rate of 125 bbl. of oil per day on 4-hour test on 20/64-in. choke from perforations in the lower Tuscaloosa at 9,174-76 ft.

Interstate Natural Gas Co. is the original discoverer of the field. Their 1 Sibley in 21-11n-12e, was completed early in 1954 for 35 bbl. of oil per day.

Homer . . . Kern-Trimble Production Co. opened two new lower Cotton Valley oil sands at Homer field in Claiborne Parish during May operations.

The B-1 Oakes, C NE SE 30-21n-7w, flowed 80 bbl. of 30.8°-gravity oil per day on ¼-in. choke from perforations at 5,148-54 ft. From the zone at 5,112-25 ft. the well flowed 125 bbl. of oil per day on 10/64-in. choke. Previous Cotton Valley production at Homer was in the Davis and Bodcaw sands.

SOUTH TEXAS

SOUTHWEST TEXAS

New Gas Pool Opened In Jim Wells County

Jim Wells County has a new gas discovery well at Flournoy Drilling Co. and Robert D. Dunn 1 Robert D. Dunn, 6 miles northeast of Alice. The well made 15,200 M.c.f. of gas per day on open flow from perforations at 3,474-78 ft. Location is in the Los Presenos de Arriba Grant, Abstract 148. Suggested name for the new producing area is Mary field.

New Gas Field Opened At Duval County Test

Standard Oil Co. of Texas opened a new gas pool in Duval County, 2½ miles southwest of Sejita.

The well flowed 12,500 M.c.f. of gas daily from perforations at 6,814-26 ft. The field will be called Sejita-6,800-ft. sand. Location is in the San Pedro de Charco Redondo Rafael Ramirez Grant, Abstract 475. The well gaged 1,694 M.c.f. of gas daily on 14/64-in. choke; 1,344 M.c.f. on 12/64-in.; 968 M.c.f. of 10/64-in., and 657 M.c.f. on 8/64-in. choke.

New Oil Sand Found In Zoller Field

Calhoun County's Zoller field has a new oil pay sand discovery at Lamar Hunt Trust Estate 1 State Tract 46, 9 miles southwest of Seadrift in Section 46 of the San Antonio Bay.

The well was completed in the Zoller-Frio "G" sand from perforations at 9,122-26 ft. Flow was 157.6 bbl. of oil per day on 10/64-in. choke. The well is the only oil producer in the field. Another well, the 1 State Tract 60, is drilling below 9,884 ft.

New Oil Pay Found At Harris County Well

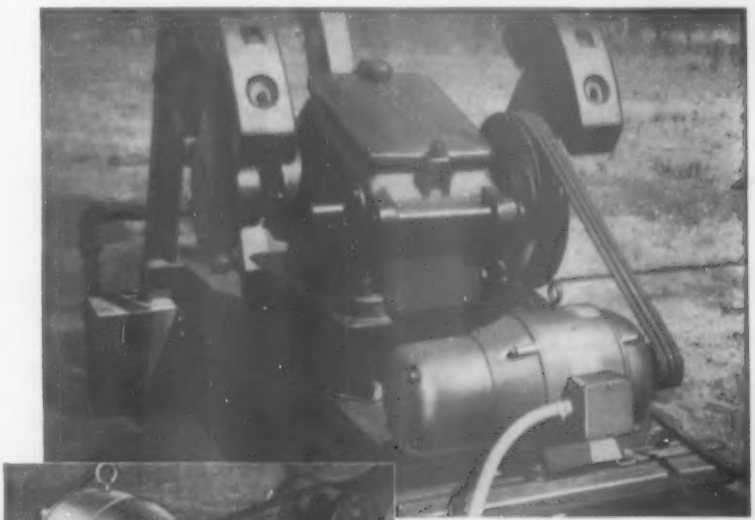
Claud B. Hamill established oil production from a new pay zone at his 1 Carl E. Benignus just east of Rotherwood field and 6,200 ft. west of Kuhlman field in Harris County.

The well, 3 miles west of Spring, flowed 4 bbl. of oil per hour on a 6-hour test of perforations at 5,872-80 ft. The discovery is shut in for storage facilities. Location is on the John Jones Survey, A-481.

Bettis Is Name for New San Patricio Hit

Bettis & Shepperd 1 A. C. Finke, 4 miles northeast of Mathis in San Patricio County, was completed for 123 bbl. of oil per day on 10/64-in. choke. Perforations were at 4,852-59 ft.

The suggested name for the new field is Bettis. Location is in the V. Juarez Survey, Abstract 11.



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SOUTH LOUISIANA

Flowing Oil Well Finaled at Shoats Creek

Sunray Mid-Continent Oil Co. has completed its 1 A. C. Chappuis as a flowing oil well in the Shoats Creek field in Beauregard Parish. The well, located 1,980 ft. from the west line and 330 ft. from the south line of 3-7s-12w, is a northwest extension of Shoats Creek field and is producing from deeper formations than the discovery gas well nearby.

The well flowed 106 bbl. of oil a day through a 7/64-in. choke during initial tests and produced gas at the rate of 190,000 cu. ft. a day. The flow was gaged following perforations at 8,988-94 ft. The discovery gas well produced gas and distillate at 8,600 ft. Both wells are producing from the lower Cockfield sands.

Tubing pressure was 1,050 lb. and shut-in bottom-hole pressure was 4,590 lb. Gas-oil ratio was about 1,000:1. Sunray Mid-Continent holds 2,600 acres in the immediate area.

New Gas Pool Opened In Calcasieu Parish

Calcasieu Parish has a new gas discovery. The well is Lee Brothers Oil & Gas Co. 1 E. O. Daughenbaugh, 29-10s-7w, 2 miles west of production in Holmwood field.

The discovery flowed at the rate of 810 M.c.f. of gas per day with some distillate from perforations at 10,536-552 ft. The discovery is shut in for potential.

OFFSHORE

New Well Added to Eugene Isle 128

Shell Oil Co. added a new oil producer to Eugene Island Block 128 area off St. Mary Parish in the Gulf of Mexico. The 1-B OCS 0478 flowed 210 bbl. of 42.4°-gravity distillate and 155 M.c.f. of gas on 9/64-in. choke. Perforations were at 6,920-38 ft.

MID-CONTINENT

KANSAS

Testing Under Way at Pratt County Prospect

Testing is under way at a new discovery well project in Pratt County. McKnab Drilling Co. 1 Barnes, SE SE SW 36-27s-15w, 5 miles south and 2 miles west of Blowout pool, recov-

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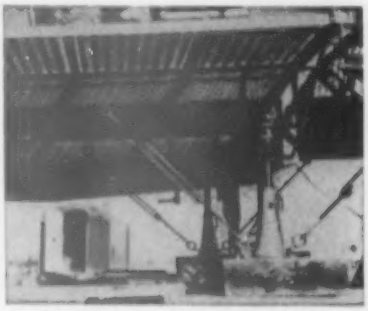

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ered 1,660 ft. of gas-cut mud on drill-stem test in the Cherokee-Pennsylvanian at 4,436-80 ft. At 4,460-80 ft. the well recovered 1,100 ft. gas-cut mud. The third test in the well gaged 606 M.c.f. daily with recovery of 150 ft. gas-cut mud reported.

NORTHERN OKLAHOMA

Excellent Well Finaled In Cherokee Trend Area

The Cherokee trend area of northern Grant and Alfalfa counties in northern Oklahoma got one of its best wells to date last week at Norman T. Smith's 2 Bodle, C SE NW 15-28n-9w.

The well flowed 65 bbl. per hour for 4 hours on ¼-in. choke after fracturing. On ½-in. choke it made 70 bbl. in 1 hour. Location is in Flowerdale field. The basal Pennsylvanian sand was perforated at 5,063-90 ft.

SOUTHWEST OKLAHOMA

Completion Near at Southwest Bradley Well

Ohio Oil Co. is completing its 1 Briscoe-C in C NE NW 10-4n-5w, Southwest Bradley field, Grady County.

The well made 29 bbl. of load and 401 bbl. of new oil in 22 hours through assorted chokes from perforations in the first Bromide sand at 13,456-13,568 ft., second Bromide sand at 13,590-13,-640 ft., and the Tulip Creek sand at 13,754-13,844 ft. On ⅛-in. choke the well flowed 192 bbl. in 24 hours with 480 M.c.f. of gas per day.

SOUTHERN OKLAHOMA

Oil Creek Production Found at Eola Well

Stanolind Oil & Gas Co. has indicated Oil Creek sand production at 2-A Willens in NW NE NE 11-1n-3w, Eola field, Garvin County.

A drill-stem test at 11,524-59 ft. had recovery of 7,900 ft. of oil and gas. The well is now being deepened to contract depth.

Dual Flow Reported at Love County Well

A dual oil flow was reported in Northeast Greenville field, Love County, at Walter Duncan 2 McKinney in SW NW SE 20-6s-2e. The well flowed 53 bbl. per hour from the Deese sand at 4,038-48 ft. and 4,452-73 ft.; from the Dornick Hills it flowed 35 bbl. per hour on tests.

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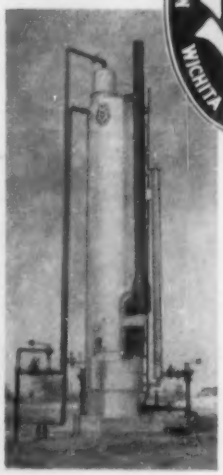

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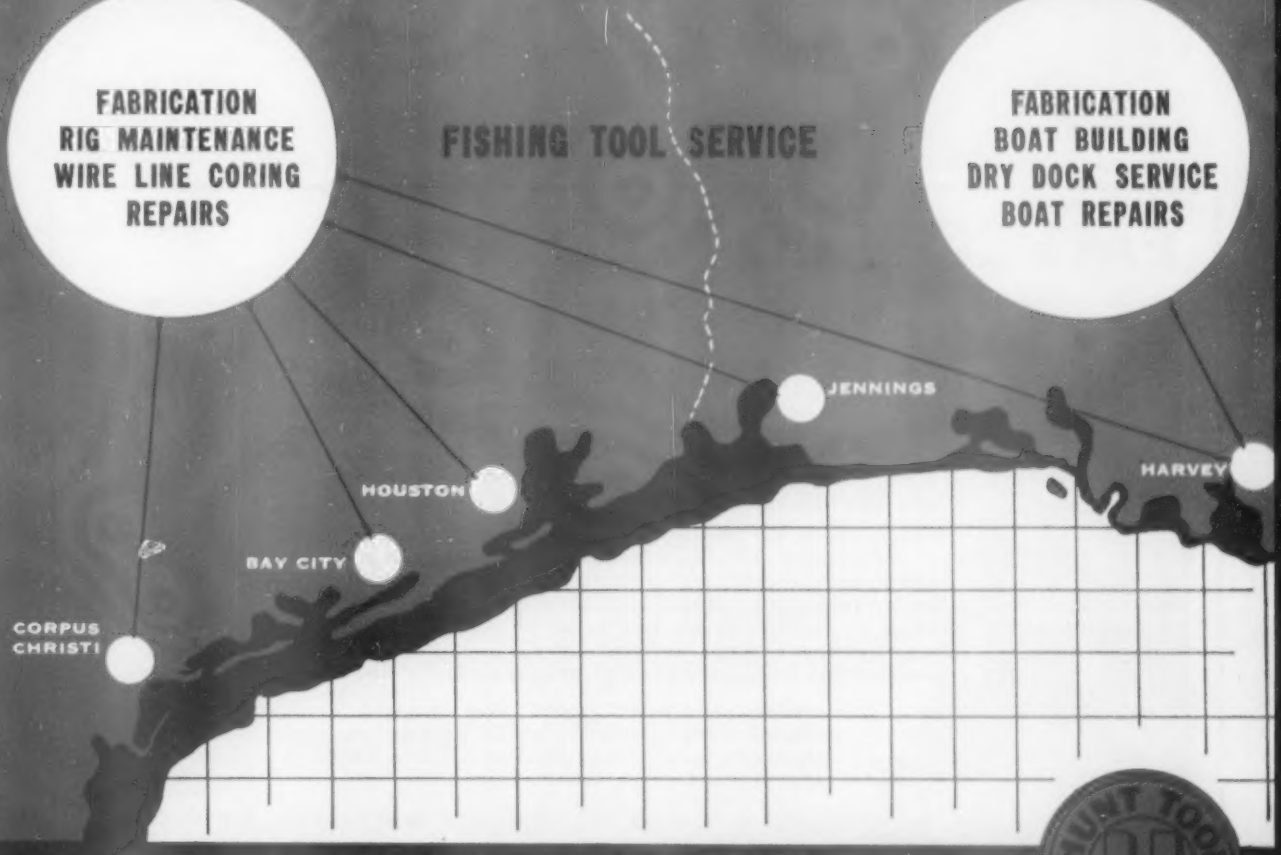

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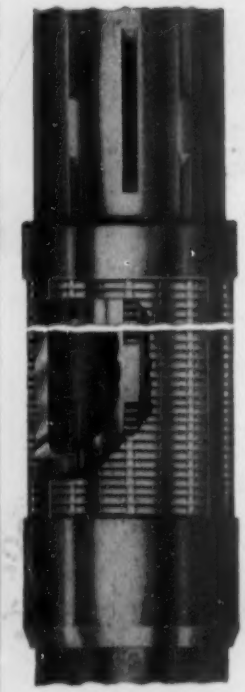

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can and Dick Wegener 2 Gilliam, NW NE SW 20. This one flowed 13 bbl. per hour from perforations at 3,710-3,884 ft.; the zone at 4,200-30 ft. made 30 bbl. hourly on choke.

New Pay Discovery Seen For Southwest Ardmore

Southwest Ardmore field in Carter County appears to have a new pay zone, the basal McLish sand. The discovery well is Sunray 1 Shipman in NW NE NE 35-5s-1e.

The well made 159 bbl. of oil per day through various chokes. Production was 59½ bbl. in 12 hours on 20/64-in. choke on 24-hour test. Perforations were at 1,831-42 ft.

Extension Indicated At East Nellie Field

Stephens County's East Nellie area is in for expansion as a result of Schafer Drilling Co.'s indicated success at 1 Nunnelly in C NW NW 8-1n-8w. This well, which is the twin to a 19-year-old dry hole, recovered 2,300 ft. of 40°-gravity oil per day and 125 M.c.f. of gas on drill-stem test of the Booth sand at 3,605-17 ft. Another well in the same area, the 4 Smith, C SW SW 5-1n-8w, flowed 349 bbl. of oil in 12 hours from perforations at 4,335-45 and 4,417-56 ft.

Madill Report

Sinclair Oil & Gas Co. completed its 3 Beard in SE SE SE 15-5s-5e, Marshall County, in Madill field. The well flowed 140 bbl. of oil in 8 hours on ¾-in. choke from the second Bromide sand at 6,190-6,214 ft. The final flow test was 224 bbl. in 24 hours on ½-in. choke.

Purdy Area Being Extended

Sunray Mid-Continent Oil Co. is making production tests at its 1 Hise in C NW NE 9-3n-4w, Purdy area. The well flowed 40 bbl. of load oil and 23 bbl. of new oil in 3 hours on 28/64-in. choke from perforations in the Hart sand at 8,987-900 and 9,033-56 ft.

Purdy Trend Well Completed by Ohio

Ohio Oil Co. 1 Harris-A, C NW SE 4-3n-4w, Purdy area, Garvin County, flowed 227 bbl. of oil per day on ¼-in. choke from perforations at 8,865-92 ft. Location is in the fast-growing Purdy district.

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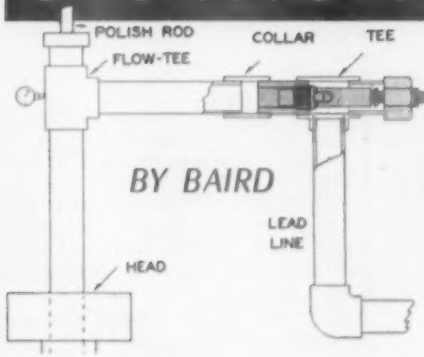

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EASTERN INTERIOR

ILLINOIS

Two New Oil Pools In Illinois in May

Two new oil pools, Bourbon North in Douglas County, and Orchardville North in Wayne County, were discovered in Illinois in May, according to Geological Survey Division of the Department of Registration and Education.

The May drilling report also lists eight extensions to pools and three new pays in pools. Two extensions were completed to Bourbon pool in Douglas County and one each to Cooks Mills Consolidated in Douglas County, Crossville in Wihte County, Divide South in Jefferson County, Huey South in Clinton County, New Bellair in Crawford County, and Olney South in Richland County. The new pays were the Silurian limestone in Huey South, the Aux Vases sandstone in Crossville, and the Cypress sandstone in Shawneetown, White County.

Drilling continued at a high rate, 319 wells being drilled during the month. Of this number, only 141 were successful, or less than half, as compared with an average of about 55 per cent successful during recent months.

Production continues slightly higher than a year ago. Estimated production in May was 7,091,000 bbl., or about 230,000 bbl. per day.

One of the interesting areas of drilling in Illinois during May was in Douglas County located near the northern boundary of the oil producing region of Illinois. In October 1955 the first successful oil well, the discovery well of the Murdock pool, was completed. In May, 24 wells were drilled in Douglas County, 11 of which were successful, including one new pool and two extension wells.

In White County, 1 mile northeast of New Haven, Mike Beeler and Calvert Drilling Co. 1 B. C. Cutting, SW SW SW 9-7s-10e, pumped and flowed 300 bbl. of oil per day from the Aux Vases sand at 2,850-71 ft. after fracturing.

GREAT LAKES

MICHIGAN

Still another possible pay zone, this one a gas showing horizon, and above the so-called Detroit River oil pay, may have been tapped in Dorr pool, Allegan County.

Very little is yet known for sure about this most recent pay, but geolo-

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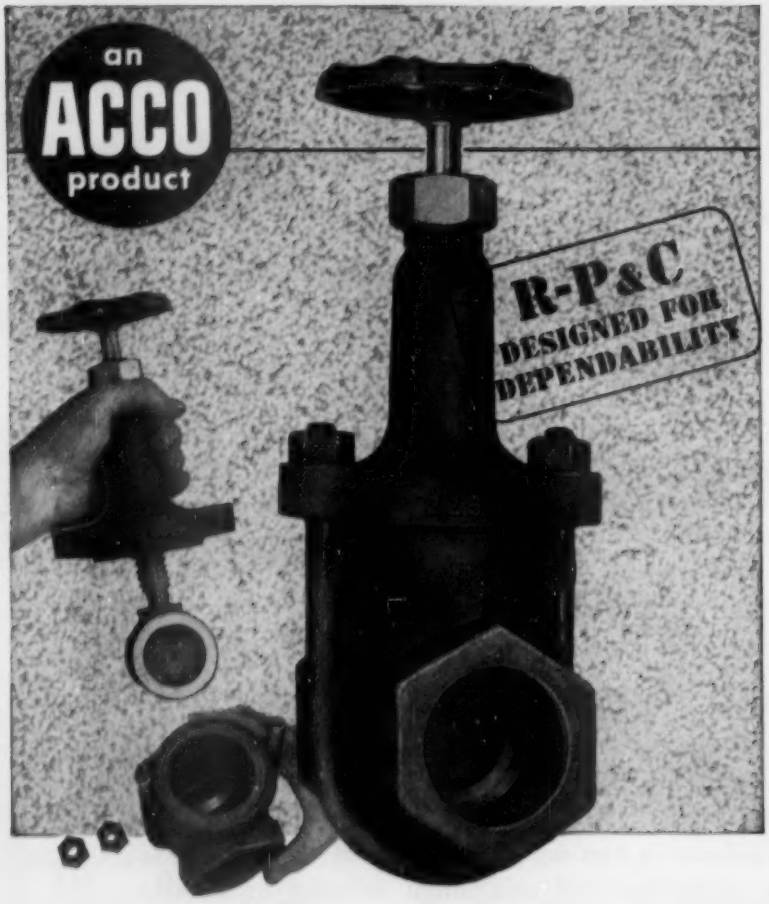

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gists are of the opinion that if it should develop as either an oil or gas-bearing horizon that it could be the best section found productive to date below the Traverse in this area. The current pay, which showed for an estimated 1,000,000 cu. ft. of gas a day, (it was tapped through a hole full of Traverse water; was heading up once every 2 hours; and was unloading hole like Old Faithful), has carried water in other wells drilled to deeper objectives in the area. The section appears to have more thickness and a better prospect of being source of substantial reserves. Gas-showing-pay was logged at 1,960-62 ft., about 200 to 250 ft. above the so-called lower Detroit River oil pay, on the extreme southeast side of Dorr Traverse pool at the Ford Oil Co. 1 Bosek & Brink, SE SW SE 29-4n-12w. This gas horizon is in the upper Detroit River sectiton. Drilling operations were being continued with cable tools in an effort to penetrate further into this section, and for penetration into the oil zone, if possible. Well was continuing to head up and flow water, activated by the gas, as deepening was attempted.

On the basis of production performance to date, the Detroit River oil pay zone, logged at about 2,100 ft. in Dorr, has not been too encouraging. Biggest significance may be determined by deeper drilling at other southwestern Michigan wildcats.

ROCKY MOUNTAIN

MONTANA

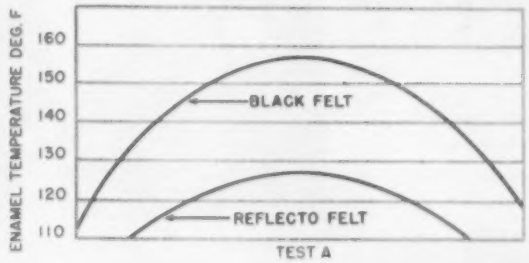
Piper Is New Pay At Wolf Springs

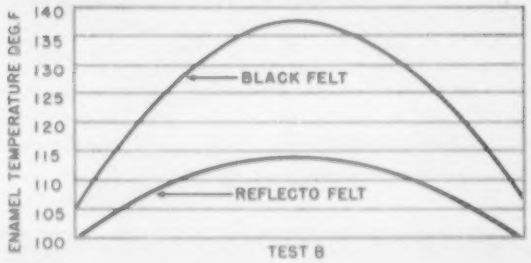
Wolf Springs field in Yellowstone County, the focal point of important development drilling in the northern Rockies this year, is in for a new pay zone in addition to its regular producing sand, the Amsden. The new pay prospect is the Piper lime of Jurassic age. The discovery well is Atlantic Refining Co.'s 13-2 Horton estate in C SE NE 13-7n-31e.

The well flowed at the rate of 113 bbl. of oil per day following acid treatment. Top of the Piper was 5,982 ft.; the Amsden at 6,030 ft. Oil flowed from the Amsden during drill-stem test at 6,036-67 ft.

The Jurassic-Piper lime overlies the Amsden throughout the Central Montana Plains region. It also is general in the Williston basin. There is production from the Piper at Northwest Sumatra field. The Amsden dolomite and the Piper lime are both highly fractured and cavernous formations.

REDUCE TEMPERATURE
of ENAMEL as much as 30°
WITH NICOLET REFLECTO-FELT





Above are the results of studies by an independent research organization upon the heat absorption characteristics of Nicolet Reflecto-Felt (white) vs. black felt.

Under controlled surface heat of 140 degrees, enamel under black felt registered 156 degrees. The enamel under Reflecto-Felt registered 126 degrees . . . A TEMPERATURE REDUCTION of 30 DEGREES.

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GM DIESEL POWER

Discovery Well at Northeast Bredette Field Completed

The discovery well of Northeast Bredette field in Daniels County has been completed. The new pool-opener, also first producer in the county, is the California Co. 1 Paulson in C NW SW 34-33n-49e. Initial flow gage was 114 bbl. of oil daily on 7/64-in. choke from the MacGowan zone at 6,720-34 ft. and the Charles C Mississippian zone at 6,746-50 ft.

Location of the new field is 2½ miles north of Bredette field, another California Co. discovery, opened last year. Production there is also from the above zones.

Big Flow Reported at Ivanhoe Heath Strike

The Heath sand discovery at Ivanhoe in Musselshell County has been recompleted flowing at the rate of 1,440 bbl. per day. The well is R. P. Oliver's 3 State in C SW SW 16-11n-31e. Flow was through 28/64-in. choke. This well was originally finaled flowing 235 bbl. per day earlier this spring.

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J. H. WILLIAMS & CO.

While drilling on one well progresses, two oil company landmen discuss lease sites in the newest hotbed of oil activity, the San Juan basin's Bisti field in the Four-Corners area. At left is District Landman Jack Goddark and Land Department Manager Ernest Potter of Sunray Mid-Continent Oil Co. The well is the 1 Federal "B" which was completed with an initial production rate of 720 bbl. of oil a day. (Photo courtesy Sunray Mid-Continent Oil Co.)

UTAH

Morrison Oil Reported At Grand County Wildcat

A wildcat in Grand County, eastern Utah, reported oil in the Morrison. It is B&W Drilling Co.'s test in NE NE NE 31-19s-25e. The operator bailed oil at the rate of ½ bbl. per hour. Top of the Morrison was 590 ft.

Location of this shallow discovery prospect is 5 miles south of Harley Dome gas field.

Shows Recovered at Aneth Field Well

Superior Oil Co. recovered oil and gas shows on tests of its 2 Navajo "A" in SW SW 14-40s-24e, extension try at Aneth field, San Juan County, Paradox basin.

The well recovered 160 ft. of drilling mud, 90 ft. oil and gas-cut mud, and 235 ft. of mud and gas-cut oil on drill-stem test at 5,692-5,772 ft. Recovery was 58 M.c.f. of gas in 12 minutes 60 ft. of mud, 730 ft. slightly mud and gas-cut oil, and 160 ft. of heavily mud and gas-cut oil at 5,795-5,875 ft.

San Arroyo Well Is Dually Completed

Sinclair has dually completed its 2 Unit in Grant County's San Arroyo field area. The well made 3,546 M.c.f. of gas daily from 5,867-95 and 5,936-60 ft. in the Dakota. From the En-

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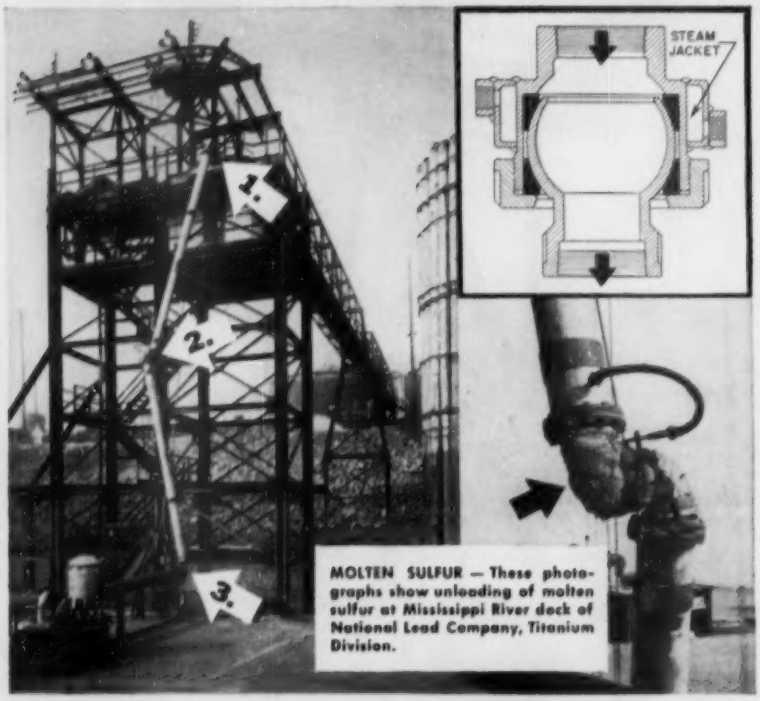

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HOT steam is the secret of handling sulfur as a liquid at barge loading and unloading docks. Barco's new Steam Jacketed Flexible Ball Joints are an integral part of the splendidly engineered installation shown above. A traveling crane raises and lowers pipe made flexible with Barco Joints. This arrangement accommodates river stages varying up to 40 feet. This permanent, maintenance-free, labor-saving installation eliminates the problems of rapid deterioration and frequent maintenance encountered with hose.

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FEATURES

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TO MEET YOUR NEEDS — Straight and angle; screwed and flanged styles. Steel casing.

FLEXIBILITY — The ball provides more than 30° total angular movement in any direction.

VERSATILE—For handling sulfur, asphalt, and other heavy materials. Heat speeds flow; cuts loading time.

ENGINEERING RECOMMENDATION—Ask for a copy of new catalog 2158 on "Barco Flexible Ball Joints for Piping."

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trada sand at 6,633-63 ft. the discovery made 11,000 M.c.f. daily. This is the third well in this new field.

Clear Creek Area Well Flows Gas

Three States Natural Gas Co. reported gas at the rate of 10,600 M.c.f. per day on tests of its 1 Kearns, NE SE 32-14s-7e, Emery County. The flow was through 2½-in. tubing. This 4,700-ft. Ferron well is in Utah's mountainous Clear Creek area.

COLORADO

Gas Flows Reported at Northwestern Wells

Pure Oil Co. reported a flow of 90 M.c.f. of gas per day at its Hunters Canyon well, the 1 Government, in SW NE NW 24-8s-101w, Mesa County. Flow was through perforations at 1,426-58 ft. This wildcat is located 2 miles northwest of Hunters Canyon field.

In Moffat County Pure tested 10 M.c.f. of gas per day on drill-stem test of the Dakota sand at 1 Government, C NW NE 14-3n-103w, East Artesia area. This well is due to hit the Weber-Penn at 8,500 ft. Location is 6 miles northwest of Rangely field.

Oil Recovered at Pierce Permian Field

The California Co. reported recovery of 4,200 ft. of very slightly mud-cut oil on a drill-stem test of the Permian Lyons sand at its 1 UPRR-O. W. Venable in C SE SE 15-8n-66w, Weld County. The Pierce field extension well was tested at 9,222-97 ft. Testing continues with total depth in the Lyons at 9,297 ft.

This well is the northwest offset to the discovery well of Pierce field. The California Co. completed that well in 1955 for 317 bbl. of oil daily on pump from the Lyons sand. The confirmation well was completed in May for 294 bbl. per day. It was the 1 Andre, C SE SE 22-8n-66w. Location is 4 miles northeast of another Permian producer, Black Hollow field, a 1953 California Co. discovery.

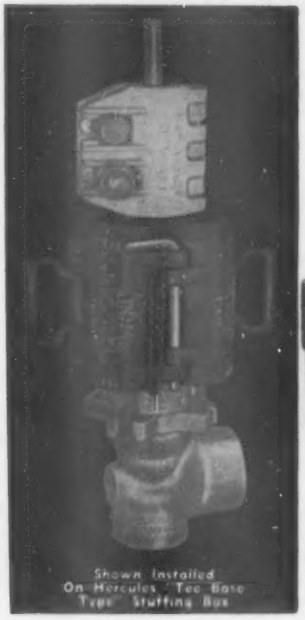
WESTERN NEBRASKA

Morrill County Discovery Gets Confirmation Well

The confirmation well to a recent Skelly Oil Co. discovery in Morrill County has been completed. Skelly 2 Lindberg, NW NE SW 11-17n-52w, was finaled pumping 316 bbl. of oil per day from the "J" sand. The field's discovery well, 1 Lindberg, NW NW

Prevent Damage to Packing and other Component Parts with a

HERCULES POLISHED ROD CLAMP-OFF SUPPORT



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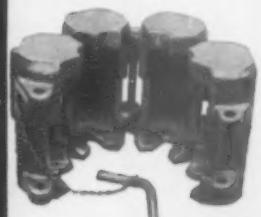

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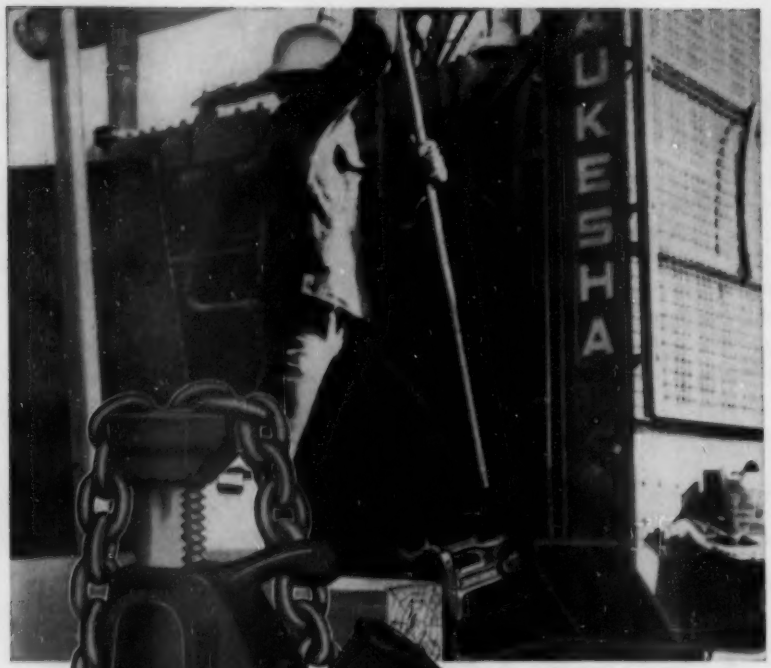

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SW 11-17n-52w, made 330 bbl. per day. A third well, the 3 Lindberg in NW NE SE 10-17n-52w, is preparing for tests.

Morrill Confirmation Finaled By Shell Oil Co.

Shell Oil Co. 1 Wilcox is a confirmation discovery to British-American Oil Producing Co. 1-D Craig, discovery well to Craig field in Morrill County. Shell's well pumped 264 bbl. of oil daily from the "J" sand. Location is in C NE SE 22-19n-52w. The British-American well also was a "J" sand discovery. The Shell well also found oil in the "D" sand.

PACIFIC COAST

CALIFORNIA

New Pool for Kraemer Field

Patrick A. Doheny has chalked up a new pool discovery with 1 Stern, drilled approximately ¾ mile southwest of regular Kraemer field production in Orange County. This 3,300 ft. wildcat was put on the pump for 33 bbl. daily of 15.5°-gravity crude. The producing interval is 3,140-86 ft.

Point of Rocks New Pool Discovery at Belgian Anticline

Standard Oil Co. of California scored a new pool find in Belgian Anticline field of Kern County. Standard's discovery, 31-22Y CWOD 3, was brought in producing from the third Point of Rocks between 4,215-4,345 ft. Initial flow was 71 bbl. daily of 31°-gravity crude through a 20/64-in. choke. This test was drilled to 5,120 ft. and then plugged back for the completion. It is located about ½ mile northeast of the Forbes pool of Belgian Anticline field.

Union Abandons Oil Creek Wildcat

Union Oil Co. has given up on 4 Richfield-Costa. This fourth test on Union's lease in the Oil Creek region of San Mateo County was drilled directionally from a site ½ mile southeast of the field discovery well. It was abandoned after one redrill job and several formation tests.

West Cat Canyon Production Extended

Getty Oil Co. has extended production in West Cat Canyon field, Santa Barbara County, about ¾ mile south

of the regular producing area. Getty put the test, 32 Los Alamos, on the pump for initial production of 200 bbl. daily of 13.9°-gravity crude. The perforated intervals in this 5,210 ft. well are 2,740-60 ft., 2,812-27 ft. and 3,093-3,107 ft.

WESTERN CANADA

ALBERTA

D3 Oil Flows at Normandville Rework

Colorado Oil & Gas Co. along with its associates, Okalta Oils, Ltd., and the Canada Oil Lands group reworking a previous Imperial Oil, Ltd., oil discovery well in the Normandville area of northwest Alberta, have opened up a zone in the D3 zone of Devonian and are currently flowing clean oil from that zone which was thought nonproductive by Imperial. The well is situated on a group of leases farmed out to Canada Oil Lands from Imperial and in turn were farmed out to the Colorado-Okalta group for exploration purposes.

The well which is undergoing the rework operations, Imperial 1 Normandville on LSD 1, 16-79-22w5, was drilled in 1949 by Imperial, and was completed as a producing D3 oil well at that time. After producing the well for a number of years the rate of water entry increased to the point where economical production was no longer feasible, consequently the well was shut in. On May 11, 1956, the Colorado team killed the well, the old perforations from 6,730 to 6,745 ft. were squeezed off and a radiation log was run. A bridge plug was set to 6,765 ft. and the intervals 6,696 to 6,704 ft. and 6,712 to 6,720 ft. were perforated.

A swabbing rate was established at approximately 1 to 1½ bbl. per hour of clean oil. The formation was then acidized with 1,000 gal. and the swabbing rate was only slightly improved. The interval 6,720 to 6,730 ft. was then perforated and a swabbing rate established at between 6 and 8 bbl. per hour of clean oil. An additional 2,000 gal. of acid were dumped and the well came in flowing. The service rig was released June 4 and the well will now be placed on an initial production test.

Willisden Green Cardium Well Completed

The team of Amerada Petroleum Corp. and the California Standard Co. has completed its Willisden Green area Cardium oil strike with an initial po-

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CASE HISTORY N°AU-WA-3122

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OPERATORS: Loffland Bros. Co., Tulsa, Oklahoma.
INSTALLATION: OWECO IDEAL 100 rig with two OWECO C.350 slush pumps, powered by three Paxman "Package" sets, 1200 total s.h.p.
PERFORMANCE: Engines into service October 31, 1954 when first well drilled was spudded in. When the well was abandoned at depth 12,915 ft., October 23, 1955 the three engines had run average of 7,845 hours each. They operated very satisfactorily and showed no wear.

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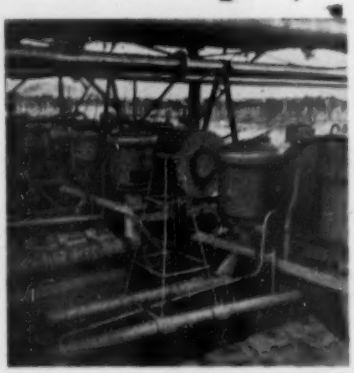

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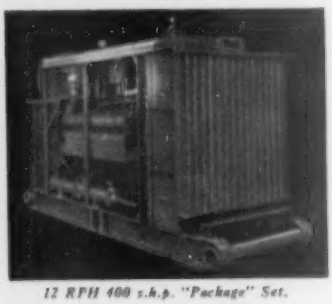

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tential of 192 bbl. per day. This recent discovery, Amerada-Cal Standard 6-6 Crown AP LSD 6, 6-43-6w5, is situated 40 miles northwest of Red Deer and 4½ miles northwest of Texaco-owned oil producers in Alhambra Cardium sand oil field.

The 6-6 Crown AP discovery well topped the Cardium formation at 5,985 ft. and the pay sand at 6,061 ft. Upon completion depth at 8,083 ft., down to which nothing but the Cardium gave encouragement, crew set production casing at 6,147 ft.

A 9-ft. section, bottomed at 6,072 ft., was then perforated and during a 4-hour production test, through a 20/64-in. choke, the 192-bbl. a day rate was established.

SASKATCHEWAN

Florence Discovery Is One of Best Yet

Imperial Oil, Ltd.'s, most recent oil discovery well in southeastern Saskatchewan, in the Florence area, 37 miles east of Estevan town, appears to be one of the best in the area. During drill-stem test conducted in the Charles zone of the Mississippian oil flowed to the surface at a rate of 6.4 bbl. in 7 minutes. Although further testing operations have been carried out by the firm, this initial test covering a 20-ft. interval and covering the top 18 ft. of porosity in the zone, was the only one reported.

This new strike is Imperial Florence 15-22, LSD 15, 22-2-34w1. It lies on wholly owned Imperial rights, midway between the Imperial 9-9 Carnduff discovery well and the Alida Oil Co. 1 Glen Ewen strike.

Porosity in the Charles was topped at the 4,232-ft. level and drill-stem was conducted over the 4,230-50-ft. interval. Gas flowed to the surface at an estimated rate of 120,000 cu. ft. daily and oil flowed 28 minutes after the packer was open. The flow rate was measured during the next 7 minutes at 6.4 bbl. of 29.5° oil.

WEST TEXAS-NEW MEXICO

WEST TEXAS

Ellenburger Prospect In Crockett County

Northern Crockett County had prospects of another Ellenburger discovery at Pure Oil Co. 1-D University. Location is northeast of Elkhorn and southeast of Barnhart, both fields producing from the Ellenburger.

Sample-top on the Ellenburger was 9,001 ft. Initial drill-stem test of the

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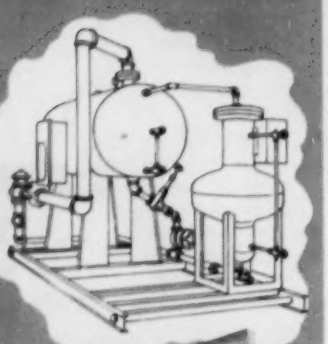

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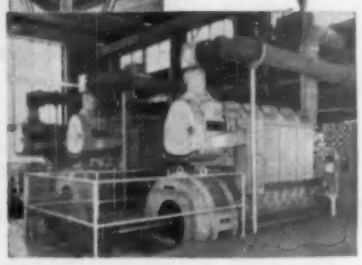

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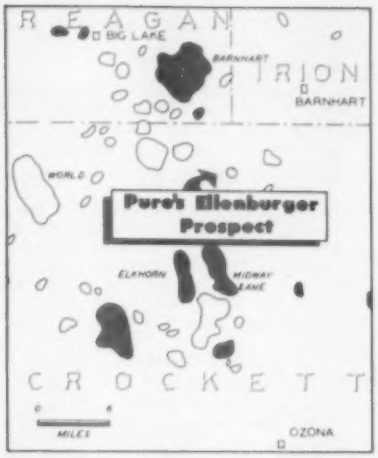

Pure Oil Co.'s wildcat, 1-D University, unloaded oil from drill pipe following a test of the Ellenburger. Shaded areas are fields having Ellenburger production.

formation was from 9,010-136 ft. Recovery was 1,400 ft. of gas in drill pipe and 180 ft. of heavily oil and gas-cut mud.

On test at 9,136-72 ft., tool open 11 hours, gas surfaced in 21 minutes. The well did not flow but unloaded 4,655 ft. of oil when coming out of the hole.

In coring ahead to 9,188 ft., recovery was crystalline dolomite, vuggy and fractured porosity, bleeding oil throughout. Plans were to core ahead. Location is in Section 11, Block 44, University Survey.

Gaines County Re-Drill Opens Penn Pay

Re-entry and drilling deeper at a Gaines County wildcat, now in the Seminole, Southwest - Devonian field, has added a new pay to that field.

J. C. Williamson 2 Riley Estate, NW NE Section 259, Block G, WTRR Survey, flowed 363 bbl. of 42° oil a day on completion test, through 18/64-in. choke from Strawn perforations at 10,406-16 and and 10,420-60 ft. Flowing pressure was 425 psi. New total depth at 2 Riley was 13,314 ft., 10 ft. into the granite.

Humble Oil & Refining Co. opened Southwest Seminole field at its 1-B Riley, approximately ½ mile west of the Williamson well. It entered Devonian pay at 11,502 ft. and flowed 383 bbl. of oil a day on completion.

Heluma field new pay . . . This Ellenburget field, opened by Texas Pacific Coal & Oil Co. 1 Jacobs Livestock Co., gained a southeast extension to Ellenburger production, plus a new pay in the Strawn, at a dual completion.

Texas Pacific 2-2 Jacobs was testing the Strawn at this report. From perforations at 7,986-8,005 and 8,040-53 ft., without acid treatment, the well flowed 116 bbl. of 41° oil in 16 hours through ¾-in. choke.

Its Ellenburger potential, making it the third for the field, was 1,260 bbl. of 48° oil, based on a flow of 315 bbl in 6 hours through 24/64-in. choke. Ellenburger perforations were from 10,620-76 ft.

Scurry County . . . Trice Production Co. 1 Adams, 156-97-H&TC, 6 miles southwest of Snyder in Scurry County, flowed at the rate of 25 bbl. of oil an hour from Canyon reef pay while drill-stem testing at 6,865-90 ft. The flow was estimated.

There was a full string of oil recovery, with no water. Top of the Canyon was 6,860 ft. on elevation of 2,319 ft. Location is 1½ miles east of Ride-Canyon pool, also opened by Trice Production.

Successful Wildcats

KENTUCKY

Muhlenberg County: F. E. Moran and Ashland Oil & Refining Co. 2 Reyher, NE NE NW 14-H-30. IPP 125 BOPD, lower O'Hara 1,146-54 ft. TD 1,154 ft. (Discovery well of Hazel Creek field.)

MICHIGAN

Allegan County: Louis Zellman 1 Helmer, SE NW NE 25-4n-13w. IPP 3 BOD

Thompson

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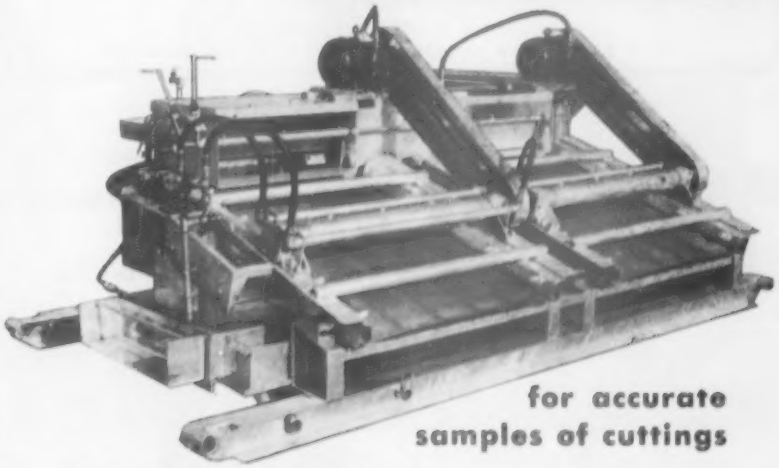

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from Middle Niagara pay, 2,746-64 ft. TD 2,764 ft. (Possible new pay in Dorr pool.)

MONTANA

Daniels County: The California Co. 1 Paulson, C NW SW 34-33n-49e. IPF 114 BOPD, 7/64-in. choke. Charles discovery, new field. TD 7,475 ft. Lodgepole.

NEBRASKA

Kimball County: Wytex Service Co. 1 Bertramson, C SW SE 5-13n-53w. IPP 86 BOPD in 12 hours. "D" sand discovery, new field. TD 5,842 ft. Skull Creek.

Murfin & Sutton 1 Fernquist, SE SE SE 6-16n-53w. IPP 80 BOPD, "J" sand discovery, new field. TD 5,915 ft. Skull Creek.

OKLAHOMA

Grant County: Seneca Oil Co. 1 Lewis, 2¼ miles southwest of Northwest Wakita in C SW NW 26-28n-7w. IPF 85 BOPD, Red Fork sand and 1,002 M.c.f. of gas per day from Red Fork at 4,880-88 ft., 38°, 14/64-in. choke. TD 4,953 ft. (Oil discovery on Cherokee trend).

SASKATCHEWAN

Imperial 13-5 Lampman, LSD 13, 5-5-6w2. TD 4,930 ft. Mississippian oil well.

TEXAS PANHANDLE

Ochiltree County: Shamrock Oil & Gas Corp. 1 J. E. Williams et ux, 4.5 miles SW of Farnsworth in Sec. 23, Blk. 4-T, T&NO Sur. IPF 119 BOPD, ¼-in. choke, 40°. Atoka sand 7,803-10 ft. TD 8,000 ft. (New oil discovery in Hugoton embayment.)

WEST TEXAS

Ector County: J. D. Hancock 1 Johnson, 44-43-T&P, 7 mi. NW Odessa. IP 269 bbl. oil in 10 hr., 24/64-in., CP 450 psi., TP not reported, GOR 500, 32°, San Andres 4,306-21 ft. TD 4,334 ft.

Reeves County: Marine Gathering Co. 1 TXL, 3-54-T4-T&P, 16 mi. NW Pecos. IPP 20 BOPD, 34°, GOR 170, top pay 4,114 ft., top Delaware sand 4,080 ft. TD 4,188 ft., elev. 2,778 ft.

Scurry County: Midstates Oil Corp. 1 Earnest estate, 31-3-H&GH, 7 mi. SE Snyder. IPP 77 BOPD, 36°, GOR 126, Strawn 6,478 ft. TD 7,045 ft., elev. 2,369 ft.

Ward County: Argo Oil Corp. 1 Hill, 226-34-H&TC, 6 mi. N Barstow. IPP 110 BOPD, 37°, GOR 1204, Delaware sand 4,716 ft. TD 4,855 ft.

WEST CENTRAL TEXAS

Haskell County: Fletcher Oil & Gas Drilling Corp. 1 Dippel, A. F. Burchard Sur. 42, 6 mi. S Rule. IPP 204 BOPD, 42°, GOR 200, Canyon 4,478-98 ft. TD 5,446 ft.

Stephens County: Leo Vessenmeier, Jr., 3 Liles, old well plugged back, MEP&P Sur., A-116, in Eloise-Mississippian field. IPP 75 BOPD, 39°, GOR 125, Strawn sand 2,706-10 ft. TD 4,543 ft., PB 2,800 ft.

Stonewall County: Cities Service Production Co. 1 Flat Top, Sec. 162, BBB&C Sur., 9 mi. SE Aspermont. IP 239 BOPD, 16/64-in. TP 280 psi., 40°, GOR 278, Swastika 3,486-94 ft. TD 4,314 ft.

Taylor County: Burton-Price Industries, Inc., 1 Webb, Wm. Clifton Sur., 5 mi. NW Bradshaw, new pay in Harper-Gray field. IP 408 BOPD, 16/64-in., TP 200 psi., GOR 200, 41°, Cross Cut 4,272-80 ft. TD 4,921 ft.

Throckmorton County: Tennessee Gas Transmission Co. 1 Liles, Sec. 292, BBB&C Sur., A-976, 3 mi. SE Throckmorton. IP 551 BOPD, 30/64-in., TP 100 psi., GOR 400, 41°, upper Caddo 4,244 ft. TD 4,258 ft.

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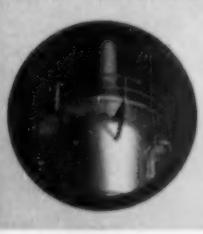

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Doctor of roustabouting . . .

. . . Chemist Rises as Explorer

IF the depression of the 1930s had lasted a bit longer, Stuart E. Buckley would have been about as educated as anyone who has ever hired out as a roustabout.

Buckley, just promoted to assistant manager of Humble Oil & Refining Co.'s exploration department, was scheduled to get his chemical engineering degree from the University of Texas in 1931, when he suddenly decided he was better off remaining in school than entering the world of business. Consequently, he postponed his graduation and carried on with his studies.

"When 1931 came along there weren't any jobs to be had," Buckley recalls, "so I stayed in school another year for some graduate work."

While continuing his studies, Buckley was able to fulfill an appointment as tutor in the chemistry department—a job, says Buckley, "which would keep me fed." A year later he received both B.S. and M.S. degrees in chemical engineering.

In 1932 there still weren't any jobs available, so Buckley retained his tutor's post and began work toward a doctorate in physical chemistry. Late that year he married the former Ethel Hilliard Bickler of Austin, put aside his studies, and scanned the almost nonexistent labor market. And an opening was found—as roustabout for Humble Oil & Refining at Conroe, Tex. Without hesitation Buckley jumped at it.

In November of that year he transferred to Houston as a research engineer. And though his training had been mostly in chemical engineering, Buckley was assigned to the production research division. He became assistant head of the division in 1939 and division head 3 years later.

Into exploration . . . In August 1954, after more than 20 years in production research, Buckley entered the exploration department in a training assignment.

Humble has a policy of shifting key personnel about from one job to another. It gives the employe a more diversified background in the industry. And it gives Humble a pool from which to draw future executives.

But seldom does one make the transition with the ease displayed by Buckley. He had passed less than 2 years in the training assignment as acting assistant chief geologist when he was elevated to assistant manager of the exploration department. He succeeds Edward J. Hamner, who was recently elected to the company's board of directors.

Certainly Buckley was familiar with the problems of exploration even before entering the geological end of the business. For a person can't spend a great deal of time in production research without worrying about finding new oil—especially one in an executive position.

Buckley has the geologist's typical optimism regarding future sources of oil in this country. He was co-editor of a 1952 report by the National Petroleum Council on "Petroleum Productive Capacity." The study concluded that, with favorable political climate and proper economic incentives, this country can supply its oil needs for an indefinite period.

Buckley still maintains this feeling. "I firmly believe there's lots of additional oil to be found in this country," he says, "and despite recent papers to the contrary, we're not on the verge of running out of oil."

The American Institute of Mining, Metallurgical and Petroleum Engineers recently presented Buckley with the Anthony F. Lucas medal for distinguished achievement in the petroleum industry.

Personal . . . Buckley and his wife have three children. The eldest, Mrs. James H. Frost of Austin, was graduated from the University of Texas this spring. John Stuart Buckley is 9 and Mary Hilliard Buckley a year younger.

Buckley claims three principal hobbies, but admits that he has been able to devote little time to them in recent years. He generally vacations in Colorado, where he fishes for trout once a year. He still hunts deer and quail in the fall, though not as much as in former days.

He is most keen about tennis. "However, I've been so busy I haven't even hit a tennis ball in quite some time," he adds regretfully.

Dr. William A. Gorman, exploration geologist for Drilling & Exploration Co., Dallas, has been named a vice president of the company. **George I. McFerron,** chief geologist for Drilexco, and **E. A. Roberts, Jr.,** production manager and coordinator of the engineering, producing, and purchasing departments, have also been made vice presidents. All will continue to serve in their present capacities.

L. J. Weigle, assistant comptroller for Carter Oil Co. in Tulsa, has been appointed division manager of the company's southern division in Shreveport. He replaces **A. R. West,** who resigned to become production manager for Tennessee Gas Transmission Co. in Houston. **C. K. Zinnecker** replaces Weigle as assistant comptroller of the company.

Homa Wood, Colorado Springs, has been named president of Broswood Oil Co., Tulsa, to succeed his brother, the late Robert H. Wood. **H. Robert Wood,** Tulsa, and **Virgil William Wood,** New Orleans, have become vice presidents and **Dudley A. Wood** secretary-treasurer.

K. E. TAPPY

Kenneth E. Tappy, formerly superintendent of Ohio Oil Co.'s Lima, Ohio, pipeline division, has been appointed superintendent of the Wyoming pipeline division with headquarters in Casper. He succeeds Clare McElhinny, who died last March. Tappy joined Ohio Oil in 1933. He was made assistant superintendent of the Lima pipeline division in 1940 and superintendent in 1952.

W. Alton Jones, chairman of Cities Service Co., New York, and **Theodore S. Petersen,** president of Standard Oil Co. of California, San Francisco, have been elected members of the board of trustees of Eisenhower Exchange Fellowships, Inc. The Fellowship was established in 1953 as a gift to President Eisenhower.

Personals

C. R. Vandervoort, formerly an independent of Midland, has joined W. E. Bakke Oil Co. as Calgary representative.

L. R. Pomeroy, production foreman for Continental Oil Co., has been transferred from Basile, La., to Benavides, Tex.

Phinn W. Townsend, Jr., reservoir engineer with Sinclair Oil & Gas Co., has been transferred from Tulsa to Denver.

B. C. Wichterman, production engineer with Skelly Oil Co., has been transferred from Bay City, Tex., to Carthage, Tex.

Malcolm D. Abel has resigned as West Texas division manager of B B M Drilling Co., Houston, to become general manager for W. E. Bakke Oil Co. in Midland.

Robert H. Angevine, formerly head of Colorado Oil & Gas Corp.'s reserve and evaluation section in Denver, is now production superintendent for D. D. Feldman Oil & Gas at Fittstown, Okla.

B. F. Owings, Jr., has resigned as assistant division manager for Continental Geophysical Co. in Midland to join Forest Oil Corp. as division geophysicist in Midland.

B. Douglas Sheffer, Sun Oil Co. geologist, has been transferred from Bismarch, N. D., to the company's Salt Lake City office.

Irvin H. Delatte, an engineer trainee with Continental Oil Co., has been transferred from Fort Worth to Houston.

Eugene O. Kuntz, professor of oil and gas law at the University of Oklahoma and assistant to **Earl Sneed, Jr.,** president of Sneed Oil Co., Tulsa, has been elected a vice president of the firm at a recent meeting of the directors.

Roland Edwards Hales, managing director of British Malayan Petroleum Co., Royal Dutch-Shell subsidiary, at Seria, State of Brunei, British Borneo, has been made a Commander in the Most Excellent Order of the British Empire by H. M. Queen Elizabeth. Hales has been instrumental in completing the rehabilitation of Seria oil field from heavy war damage.

Kentucky Association Picks New Officers

O. H. Horne, seated left, general manager of Inland Gas Corp., Ashland, Ky., was elected president of the Kentucky Oil and Gas Association at the group's annual meeting in Lexington. Other new officers are: seated left to right, M. G. Powers, president of Red Rock Petroleum Co., Huntington, W. Va., vice president; and K. Z. Wilking, independent, Owensboro, Ky., vice president; standing, left to right, F. J. Zogg, Owensboro, vice president; E. J. Reading, tri-state manager for Sun Oil Co., Evansville, Ind., vice president; Angus McDonald, Lexington, secretary; and Robert Reilly, Owensboro, executive secretary. Not pictured is V. O. Sims, Felmont Corp., Owensboro, vice president.

C. Calvin Naylor has been promoted from superintendent of refining at Sun Oil Co.'s Marcus Hook refinery to refinery manager, succeeding **W. T. Askew,** who is being detached from the company's refinery division for a special assignment. Succeeding Naylor as superintendent of refining is **Walter C. Huffman,** formerly assistant superintendent of petrochemicals at the plant. **James I. Harper,** who has been assistant director of Sun's research and development department in Philadelphia, succeeds Huffman at Marcus Hook. **John L. Olsen,** formerly in charge of technical economics in the research and development department, succeeds Harper. **Frederick A. Lang,** assistant superintendent of catalytic cracking at Marcus Hook, has been appointed to the new position of assistant superintendent of coordination. **William A. Casey,** assistant to the refinery manager, succeeds Lang in catalytic cracking.

C. C. NAYLOR

W. C. HUFFMAN

John Thomas Reagan, petroleum engineer, formerly with Phillips Petroleum Co. at Fort Stockton, Tex., is now with Lion Oil Co., division of Monsanto Chemical Co., at Fort Morgan, Colo.

R. C. Frederick has resigned from Pacific Northwest Pipeline Corp., Houston, where he was vice president of gas sales and purchases, to rejoin Gulf Oil Corp. in Pittsburgh. He will enter Gulf's new planning and economics department. Frederick had been with Gulf for 28 years. He joined Pacific last year.

Walter J. Durham has joined Texas Butadiene & Chemical Corp. as production supervisor. He was formerly assistant refinery superintendent at Suntide Refining Co.'s Corpus Christi plant. Other additions to the T. B. & C. organization include: **Richard E. Driscoll,** formerly process engineer with Phillips Chemical Co. at Bartlesville, Okla., as a chemical engineer; **L. P. Michel,** formerly with Godfrey L. Cabot, Inc., of Boston, as head of the plant process section; and **Herman L. Davis,** formerly with Cabot Carbon Co., as a chemical engineer.

Dick Wing, geologist with The Texas Co., has been moved from the Bismarck, N. D., office to Denver.

Gordon S. Scruggs, formerly on the geological staff of Amerada Petroleum Corp. has been appointed staff geologist for Canso Oil Producers, Ltd., Calgary.

William D. Miller, vice president of Forest Oil Corp., Bradford, Pa., will head operations at the corporation's new Canadian division office in Calgary. **Edward J. Baltrusaitis** will be exploration manager.

Walter O. Naramore, formerly instrument superintendent at Cushing, Okla., for Midland Cooperatives, Inc., is now instrument engineer for Frontier Chemical Co. in Wichita.

N. Knowles, chief engineer of the Georgia Public Service Commission since 1937, has joined Tennessee Gas Transmission Co. as director of rates. Knowles was chief of the power supply allocating section of the War Production Board in Washington during 1942 and 1943.

Dr. Simon Miron has been promoted to research associate and **R. L. Aiken** to senior chemist in American Oil Co.'s research and development department at Texas City, Tex. Miron was formerly a research chemist in the analytical division while Aiken served in the methods development section of the research department.

C. B. Keagy, head chemist at Humble Oil & Refining Co.'s Katy, Tex., gas cycling plant, has been named gas measurement supervisor of the eastern division. **W. G. Robb,** senior industrial gas serviceman, has been transferred from the Tomball district, Gulf Coast division, to the Flour Bluff district, southwest Texas division. Humble engineering changes include **Weldon R. Shuck,** civil engineer in the north Texas division office, to the western division office; **T. E. Hilton,** senior civil engineer in the East Texas division office, to the eastern division office; **C. E. Ullrich,** senior supervising civil engineer in the civil engineering division, Houston, to the north Texas division as assistant division civil engineer; **L. M. Harris,** petroleum engineer in the Gulf Coast division office, to the California area office; **M. F. Clegg, Jr.,** senior gas engineer in the gas engineering division, Houston, to the Gulf Coast division office as senior petroleum engineer; and **G. K. Myrhaugen,** civil engineer in the East Texas division office, to the eastern division office.

H. J. Gruy, consulting engineer, formerly a partner in the firm, Gruy & Durst, Fort Worth, has opened offices in Dallas as H. J. Gruy & Associates.

Robert E. Miller, formerly of Wichita Falls, Tex., is now a general partner in Gilchrist Drilling Co., Abilene. The company is active in West Central Texas.

W. F. Brown, superintendent of Continental Oil Co.'s Lake Charles, La., refinery, has been promoted to the

W. F. BROWN

K. S. ANDREA

newly created position of assistant manager of manufacturing for Conoco's Rocky Mountain region with headquarters in Denver. He is succeeded at Lake Charles by **K. S. Andrea,** formerly assistant superintendent of the Billings, Mont., refinery and more recently an assistant to the vice president.

Dr. D. R. Derry has been elected president and managing director of Rio Canadian Exploration, Ltd. Formerly executive vice president of the company, Dr. Derry replaces **O. Weiss,** who has resigned. **J. A. Sadler,** formerly chief mining engineer for Manitoba, has been appointed assistant manager of Rio Canadian. He replaces **B. I. F. Beakey,** who has resigned.

Personals

W. L. Carr, district geologist in Bismarck, N. D., for Pure Oil Co., has been transferred to Caracas, Venezuela. **Jack W. Pierce,** formerly in the company's Casper, Wyo., office, has succeeded Carr in Bismarck.

E. J. Grivetti has become division geophysicist for Continental Oil Co.'s Billings, Mont., exploration division. Formerly a geophysical supervisor in Billings, he succeeds **A. W. Black,** who has been transferred to the company's Rocky Mountain region offices in Denver.

Ernest S. Wells, Jr., has been appointed Denver division manager in Sunshine Mining Co.'s petroleum division. Wells was formerly manager of land and leases for Macmillan Petroleum Corp. in Oklahoma City. **George L. Gear,** formerly with Natural Gas & Oil Co., has been named Denver division production superintendent for Sunshine, and **Nolan H. Ashburn** has been named division geologist.

Caldwell Starkey has been named district geologist for Jamaican Stanolind Oil Co. in Kingston, Jamaica. Starkey was formerly district geologist in charge of exploration activities for the Corpus Christi, Tex., district of the parent Stanolind Oil & Gas Co. In Kingston, Starkey succeeds **Howard W. Schwartz,** who has been transferred to Jamaican Stanolind's geophysical interpretive office at Hialeah, Fla. Schwartz will coordinate geophysical operations in both Jamaica and Cuba.

DEATHS

Morton T. Higgs, 60, vice president in charge of operations and sales for Lane-Wells Co. until last year, died recently in Los Angeles. Higgs joined Lane-Wells in 1938. He was named vice president for operations and sales in 1952.

T. P. Jones, 93, leader in the development of Montana's Kevin-Sunburst field in the early 1920s, died recently at Moscow, Idaho. Jones was former president of Troy-Sweetgrass Oil Syndicate and Potlatch Oil & Refining Co.

Thad Louis Putnam, 60, president of the Export Foreign Tools Co. of New York, died of a heart attack June 6 at Conroe, Tex. Putnam resided in Houston until 1952, when he moved to Conroe.

Mark T. Wilson, Sr., 68, independent operator of Dallas, died there June 9. Wilson had been in industry operations since 1927 and had properties in El Dorado, Ark., Shreveport, Jackson, Miss., and Longview, Tex.

Roderick Tetrick, geologist with Socony Mobil Oil Co. at Worland, Wyo., and formerly with Magnolia Petroleum Co., died of a heart attack recently at Worland.

Hilmar H. Weinert, 69, president of Trio Oil Co., Seguin, Tex., and Tex-Ill Oil & Royalty Co., died June 11 at Seguin after an extended illness.

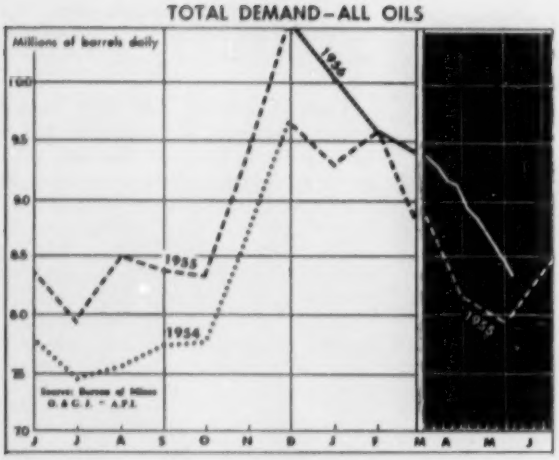
Joseph V. Dunbar, 61, drilling contractor, died recently at his home in Denver.

Latest Figures . . . Industry Trends

A QUICK LOOK AT THE HIGHLIGHTS

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,993,100	DOWN	50,740	UP	372,178
Crude stocks	275,693,000	DOWN	2,443,000	DOWN	2,543,000
Completions	1,157	DOWN	36	UP	148
Refinery runs	8,029,000	DOWN	43,000	UP	507,000
Gasoline stocks	184,409,000	DOWN	461,000	UP	18,176,000
Kerosine stocks	22,903,000	UP	1,024,000	DOWN	4,129,000
Distillate stocks	80,637,000	UP	3,238,000	DOWN	7,777,000
Residual stocks	36,742,000	UP	906,000	DOWN	8,452,000
Four-product stocks	324,691,000	UP	4,707,000	DOWN	2,182,000
Total imports	1,442,100	UP	396,500	UP	364,600

TOTAL DEMAND—ALL OILS



Product Market Trends Are Irregular; Crude-Price Adjustments Continue

PETROLEUM markets failed to follow a definite pattern in the first half of June. Gasoline was firm in some areas while service-station price wars plagued marketers in other districts. An advance in cargo prices for light fuels on the East Coast still left some discounting on barge deliveries in the New York Harbor area. Some suppliers are watching for signs of a steel strike as an indicator of late-summer residual prices. Crude seems to be more under the influence of product weakness rather than the spots of strength in the product market.

Esso Standard Oil Co. announced tank-wagon gasoline-price increases for Virginia, West Virginia, Maryland, Delaware, and District of Columbia, effective June 11. Esso also set its consumer tank-wagon prices for gasoline 0.5 cent a gallon above prices to dealers.

Violation suits under New Jersey's fair-trade laws by suppliers in the area have tended to stop some of the cutthroat competition in that state.

On the other hand, allowances to dealers in New England have increased. These allowances amount to about 5 cents a gallon in Providence, and 4 cents in Boston.

Service-station price wars continue in Tulsa, Oklahoma City, and in a large area east and southeast of Kansas City. The lowest station posting for regular gasoline in Tulsa is 21.9 cents a gallon. Normal refinery quotation for Oklahoma delivery of regular gasoline is 12.00 cents a gallon. State and federal tax amounts to 8.50 cents, and transport-truck delivery to a station from a local refinery would be about 0.35 cent. These costs add up to 20.85 cents a gallon which leaves very little for operating expenses when the product sells for 21.9 cents. No further reductions in prices are expected since Oklahoma has a law requiring a gross retail profit of 6.0 per cent.

Premium-grade gasoline is in short supply on the Gulf Coast. If other marketers on the East Coast add a super-premium gasoline to the motor-fuel line, high-octane components will be harder to find on the Gulf Coast. Demand for top-quality regular gasoline is reported to be very good on the Gulf Coast.

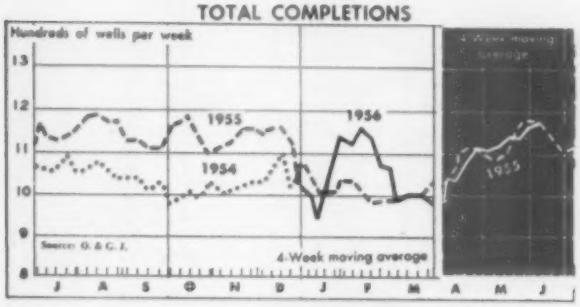
Suppliers are putting very little pressure behind the summer movement of light fuels, but if stocks continue to increase at recent rates, some refiners will be needing clean storage. Middle-distillate stocks gained 11,262,000 bbl. for the 2-week period ended June 8. Gasoline stocks normally decrease at this time of the year but gained 900,000 bbl. for the above 2-week period.

Residual stocks are gaining, but demand for heavy fuel road oil, and asphalt will prevent any abnormal buildup of heavy product stocks unless there is a steel strike this summer.

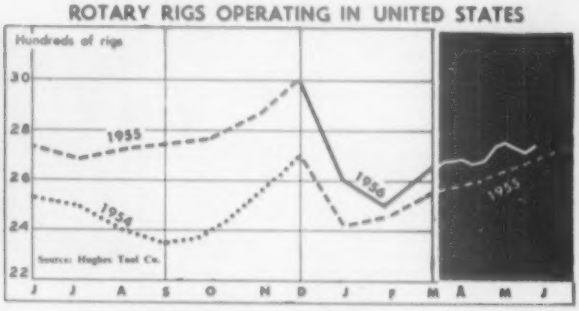
Recent adjustments in sweet-crude prices in Wyoming have been followed by reductions in the Illinois basin area. Purchasers, representing about 60 per cent of production in Illinois, Indiana, and western Kentucky, cut postings 10 cents a barrel to $2.90.

The over-all crude market has been under some pressure from rapid additions to crude inventories. High refinery runs may shift the pressure to products.

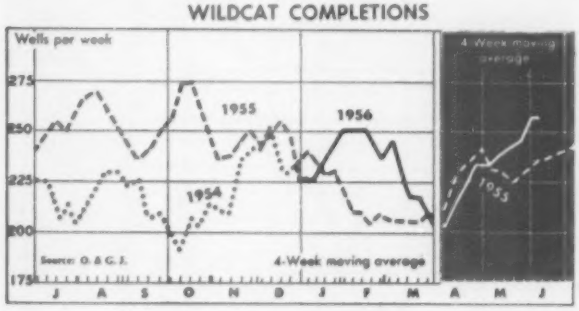
TOTAL COMPLETIONS



ROTARY RIGS OPERATING IN UNITED STATES



WILDCAT COMPLETIONS



ACTIVE ROTARY RIGS*

Area—	6-11-56	6-4-56	6-13-55
North Central and East	134	126	138
Southeast	29	29	41
Okla., Kans., Ark., Mo.	497	462	539
Louisiana	451	452	420
North and East Texas-Panhandle	435	432	415
Gulf and South Texas	240	249	240
West Texas-New Mexico	568	564	530
Rocky Mountain	274	274	266
Pacific Coast	127	120	150
Total United States	2,755	2,708	2,739
Western Canada	248	226	167

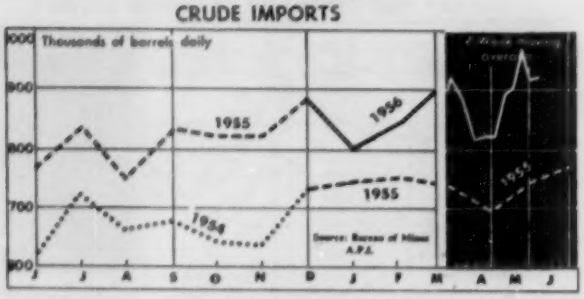
*Hughes Tool Co.

WEEKLY WELL COMPLETIONS . . . WEEK ENDED JUNE 9, 1956

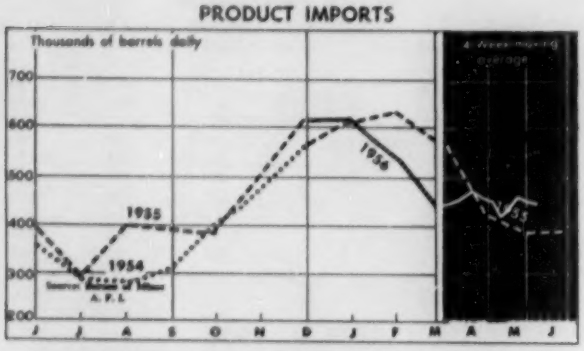
	Total of all wells					Cum.		Wildcat completions and discoveries					Cumulative total, 1956				
	Comp.	Oil	Gas	Dry	Footage	1956	1955	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
Ala.-Ga.-Fla.	2	2	0	0	23,100	44	40	0	0	0	0	0	0	0	1	21	22
Arkansas	13	8	0	5	39,696	337	318	1	0	0	3	4	16	0	2	53	71
California	60	48	0	12	298,438	966	1,152	2	0	0	8	10	19	0	3	180	202
Colorado	19	4	0	15	100,386	514	602	0	0	0	11	11	14	0	6	222	242
Illinois	90	39	0	51	207,107	1,568	1,551	1	0	0	17	18	26	0	0	265	291
Indiana	9	1	0	8	17,050	271	331	0	0	0	2	2	9	0	1	52	62
Kansas	115	54	8	*53	395,559	2,239	2,258	4	1	1	18	24	56	2	12	392	462
Kentucky	26	15	0	11	37,711	716	543	3	0	0	5	8	20	0	1	159	180
Louisiana	66	38	3	25	464,857	1,679	1,764	3	0	0	7	10	51	29	28	224	332
North	34	22	0	12	105,966	653	951	1	0	0	5	6	12	1	1	84	98
South	28	14	3	†11	322,180	820	813	1	0	0	2	3	31	25	18	125	199
Offshore	4	2	0	2	36,711	206		1	0	0	0	1	8	3	9	15	35
Michigan	6	4	0	2	17,922	193	231	1	0	0	1	2	5	0	0	63	68
Mississippi	12	7	0	5	94,122	195	213	0	1	0	3	4	7	1	1	74	83
Montana	6	4	0	†2	17,926	144	143	1	0	0	2	3	6	0	0	38	44
Nebraska	21	6	0	15	114,491	428	308	1	0	0	11	12	17	0	0	198	215
New Mexico	36	11	18	7	154,879	813	649	1	0	0	2	3	23	0	5	73	101
Northwest	22	3	16	3	81,469	314	186	0	0	0	0	0	2	0	5	22	29
Southeast	14	8	2	4	73,410	499	463	1	0	0	2	3	21	0	0	51	72
North Dakota	1	0	0	1	3,429	103	95	0	0	0	1	1	7	0	0	22	29
Ohio	24	16	3	*5	56,944	459	484	0	0	0	0	0	0	0	1	4	5
Oklahoma	188	113	14	‡61	661,441	3,894	3,793	5	1	4	17	27	61	14	20	324	419
Pennsylvania-New York	10	0	5	5	52,126	423	746	0	0	0	1	1	0	0	3	3	6
Texas	433	248	11	174	1,730,258	9,676	8,695	12	0	2	105	119	335	20	82	2,089	2,526
Southwest (1 & 4)	50	26	5	19	195,502	1,403	1,369	2	0	0	15	17	66	5	28	388	487
Gulf Coast (2 & 3)	51	29	0	22	347,373	1,196	1,139	1	0	0	16	17	29	8	32	311	380
East (5 & 6)	17	7	1	9	88,353	491	418	0	0	0	6	6	7	1	5	180	193
North Central (7-B & 9)	192	90	0	102	544,120	3,508	3,132	4	0	0	49	53	149	0	2	838	989
West (7-C & 8)	88	69	0	19	423,953	2,521	2,193	5	0	0	18	23	81	0	7	345	433
Panhandle (10)	35	27	5	3	130,957	557	444	0	0	2	1	3	3	6	8	27	44
Utah	1	0	1	0	3,900	38	31	0	0	0	0	0	1	0	2	21	24
West Virginia	5	0	4	1	14,557	291	264	0	0	0	1	1	0	0	2	6	8
Wyoming	14	9	0	5	64,212	331	344	1	0	0	4	5	8	0	5	84	97
Miscellaneous	0	0	0	0	0	57	15	0	0	0	0	0	4	0	0	44	48
Total United States	1,157	627	67	463	4,570,111	25,379	24,570	36	3	7	219	265	685	66	175	4,611	5,537
Total previous week	1,193	682	91	420	4,787,924			30	1	7	218	256	649	63	168	4,392	5,572
Total June 11, 1955	1,009	551	68	390	4,129,470			32	3	5	185	225	674	98	157	4,183	5,112
Cumulative 1956	25,379	13,985	1,670	9,724	103,446,694												
Western Canada	75	60	3	12	369,087	1,028											

Service wells included: *3, †1, ‡4.

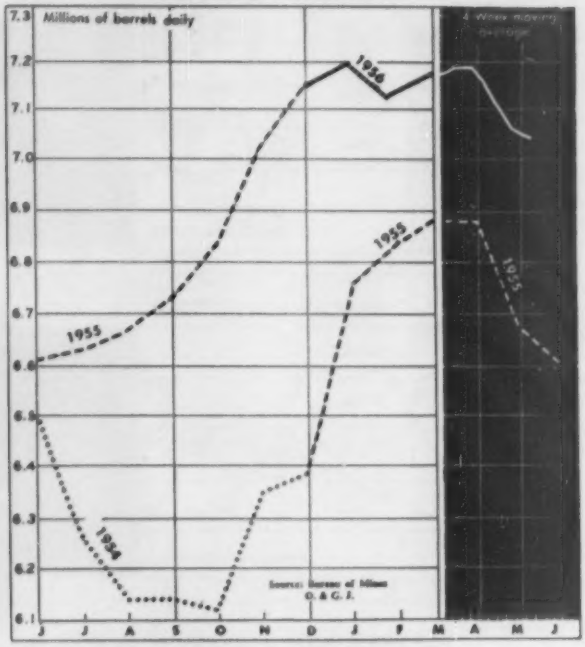
CRUDE IMPORTS



PRODUCT IMPORTS



CRUDE-OIL PRODUCTION

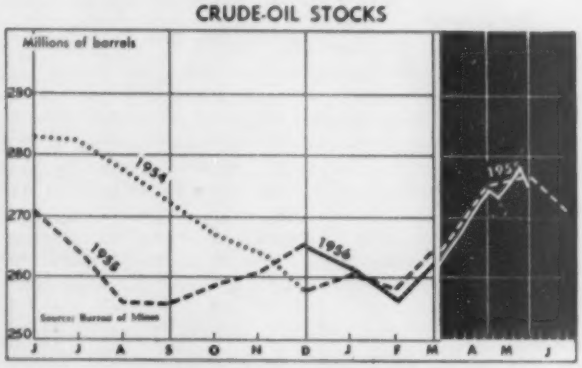


DAILY AVERAGE PRODUCTION FOR WEEK

	June 9, 1956 Crude oil	Lease condensate	Total	June 2 total
Alabama	5,300	.....	5,300	5,200
Arkansas	75,500	450	75,950	75,250
California	967,200	.....	967,200	966,200
Colorado	169,000	.....	169,000	169,200
Eastern	49,800	.....	49,800	49,000
Florida	1,350	.....	1,350	1,375
Illinois	226,200	.....	226,200	227,400
Indiana	31,500	.....	31,500	31,200
Kansas	325,600	.....	325,600	342,200
Kentucky	47,800	.....	47,800	48,100
Louisiana	726,200	60,300	786,500	790,500
North	122,200	2,300	124,500	124,500
South	604,000	58,000	662,000	666,000
Michigan	28,200	.....	28,200	27,900
Mississippi	106,800	4,250	111,050	110,700
Montana	59,700	.....	59,700	58,900
Nebraska	37,300	.....	37,300	40,700
New Mexico	235,500	4,600	240,100	244,400
North Dakota	28,200	.....	28,200	25,100
Oklahoma	557,200	.....	557,200	565,100
Texas	2,908,000	48,450	2,956,450	2,975,215
Dist. 1	54,000	425	54,425	55,225
Dist. 2	145,000	8,025	153,025	158,175
Dist. 3	428,000	22,625	450,625	450,700
Dist. 4	231,000	5,350	236,350	239,900
Dist. 5	44,000	425	44,425	45,450
Dist. 6	120,000	5,500	125,500	127,850
East Texas Field	204,000	.....	204,000	209,500
Dist. 7-B	153,000	50	153,050	152,050
Dist. 7-B	184,000	3,800	187,800	189,005
Dist. 8	1,034,000	1,700	1,035,700	1,043,800
Dist. 9	216,000	400	216,400	209,400
Dist. 10	95,000	150	95,150	94,160
Utah	5,100	.....	5,100	5,200
Wyoming	283,400	.....	283,400	284,700
Others	‡200	.....	‡200	300
Total U. S.	6,872,050	118,050	6,993,100	7,043,840
Change from previous week, down			50,740	.....
Canada	†316,740	.....	†316,740	385,600
Total U. S. production January 1-June 9			1,154,838,630 bbl.	
Same period last year (crude plus cond.)			1,087,284,194 bbl.	

*Includes 17,489,175 bbl. condensate. †Week ended previous Monday. ‡Nevada.

CRUDE-OIL STOCKS



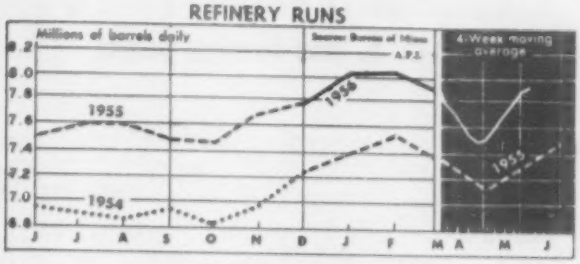
CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

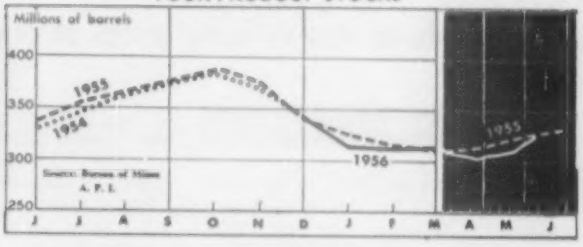
	6-2-56	5-26-56	6-4-55
Pennsylvania Grade	2,697	2,683	2,896
Other Appalachain	2,236	2,371	2,030
Illinois, Indiana, Michigan	10,514	10,801	12,156
Nebraska, North Dakota	2,452	2,348	2,405
Kansas	8,897	8,987	8,467
Oklahoma	27,106	28,196	24,364
Arkansas	2,992	3,143	2,904
Louisiana	16,225	16,343	17,034
North	2,641	2,711	2,671
South	13,584	13,632	14,363
Mississippi	3,002	2,990	2,893
New Mexico	8,111	7,693	8,340
Texas	126,435	126,008	129,232
East Texas proper	9,222	9,049	10,094
West Texas	61,548	62,248	57,212
Texas Gulf	23,442	22,701	26,473
Other Texas	32,223	32,010	35,453
Wyoming	17,985	17,629	15,426
Other Rocky Mountain	6,213	6,389	5,113
California	28,103	27,970	31,317
Foreign	†12,725	14,585	13,659
Total	275,693	278,136	278,236

*Bureau of Mines. †Includes 2,910,000 bbl. in California.

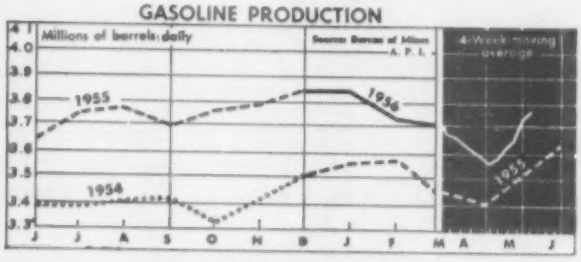
REFINERY RUNS



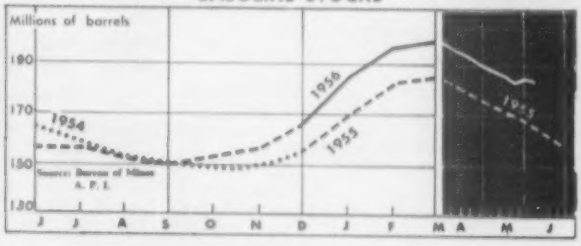
FOUR-PRODUCT STOCKS



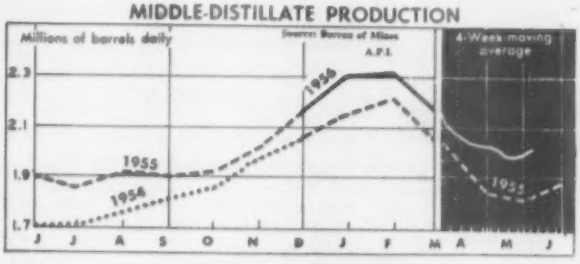
GASOLINE PRODUCTION



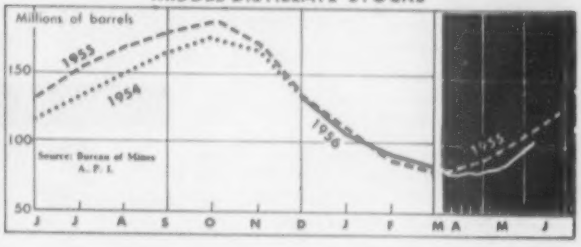
GASOLINE STOCKS



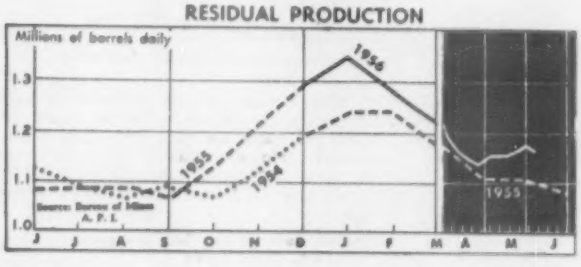
MIDDLE-DISTILLATE PRODUCTION



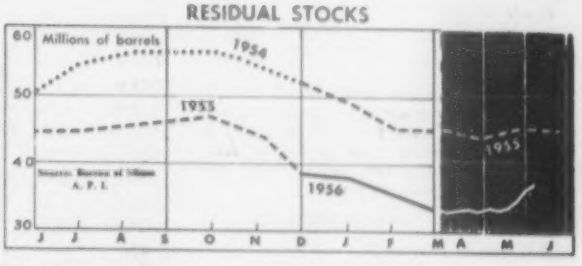
MIDDLE-DISTILLATE STOCKS



RESIDUAL PRODUCTION



RESIDUAL STOCKS



A.P.I. REFINERY REPORT, JUNE 8

(Thousands of barrels)

District—	Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.	Stocks‡—Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, June 1955—Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.
East Coast	1,121	449.8	35.9	257.7	183.1	41,042	8,739	22,026	8,784	1,026	421.9	27.4	253.9	176.7
Appalachian:														
District 1	111	46.4	4.3	26.7	6.0	4,404	368	1,380	345	91	34.3	2.9	20.9	4.6
District 2	91	52.9	4.6	12.3	13.3	3,042	575	672	263	100	50.3	4.0	13.2	10.7
Ind., Ill., Ky.	1,365	708.0	80.4	232.0	171.3	34,127	3,976	11,279	4,276	1,404	748.5	63.0	259.3	165.0
Minn., Wis., Dak.	93	46.6	6.6	28.3	9.6	6,926	544	3,516	323	(§)	(§)	(§)	(§)	(§)
Okla., Kans., Mo.	730	383.4	22.1	187.7	33.3	16,902	1,150	8,100	1,157	704	414.4	19.9	153.5	30.3
Inland Texas	276	200.7	6.0	47.9	23.4	6,601	434	1,648	1,409	247	176.4	8.1	47.5	20.4
Texas Gulf Coast	2,048	934.3	101.4	527.7	262.0	24,561	3,462	12,415	4,984	1,811	845.7	91.8	435.1	241.2
La. Gulf Coast	733	384.6	36.2	180.7	51.0	9,678	2,528	5,611	1,779	675	338.6	36.6	188.1	51.4
N. La. and Ark.	99	29.4	5.1	25.0	7.7	4,434	408	1,485	103	95	35.3	6.1	24.2	6.1
Rocky Mountain:														
New Mexico	23	11.9		3.9	2.9	428	3	89	10	23	10.6	0.5	3.7	3.2
Other Rocky Mtn.	283	131.1	2.4	71.8	38.0	7,490	313	2,495	847	268	119.3	3.9	61.4	33.1
California	1,056	498.3	0.7	125.7	347.1	24,774	403	9,921	12,462	1,040	447.8	5.3	167.2	337.0
June 8, 1956	8,029	3,877.4	305.7	1,727.4	1,148.7	184,409	22,903	80,637	36,742	7,484	3,643.1	269.5	1,628.0	1,079.7
June 1, 1956	8,072	3,888.3	282.6	1,797.1	1,188.4	184,870	21,789	77,399	35,836					
June 10, 1955	7,522	3,712.1	225.6	1,679.3	1,136.6	166,233	27,032	88,414	45,194					

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines. §Included with Ind., Ill., Ky.

Crude-oil and refinery prices at representative U. S. and foreign points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):

Regular (88 octane)	11.75-12.00
Premium (96 octane)	13.50-13.75

Gulf Coast (cargoes for coastwise or export movement):

Regular (90 octane)	11.25-11.50
Regular (92 octane)	11.50-12.00
Premium (97 octane)	13.00-13.25
Premium (98 octane)	13.25-13.75

California—Los Angeles (rack):

Regular (84 octane)	12.9-13.40
Premium (93 octane)	14.0-14.25

Caribbean area (cargoes):

Regular (87 octane)	10.50
Premium (93 octane)	11.75

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:

Grade 26-70	4.5

Breckenridge:

Grade 26-70	4.0

*If 26-70 natural is considered as 100 per cent, prices for lower-vapor-pressure grades increase 2.5 per cent for each unit drop in Reid vapor pressure down to and including 16-lb. Prices for grades below 16-lb. may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):

Kerosine 42-44	10.00-10.25
Diesel oil (58 d.i. and above)	9.625-9.875
Distillate No. 1	9.625-9.875
Distillate No. 2	9.00-9.25

Gulf Coast (cargoes):

Kerosine 41-43	95.
Distillate No. 2	8.75-9.25

New York Harbor (barges):

Kerosine 41-43	10.85
Distillate No. 2	10.35
Diesel fuel, 48-52 d.i.	10.65

Caribbean area (cargoes):

Distillate No. 2	8.75

WAX (LB.)

Oklahoma (Group 3):

132-135 A.m.p. (semi-refined) in tank cars	6.50

New York (export):

126-130 A.m.p. crude scale (solid in bags or barrels)	7.35

★Denotes change from previous week.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3): Residual fuel (max. 1% S)	$2.00-2.10
Gulf Coast (cargoes): Bunker C fuel	$2.10
New York Harbor (barges): Bunker C fuel	$2.65
Caribbean (cargoes): Bunker C at Aruba, N.W.I.	$2.10
California (rack): Bunker C fuel, Los Angeles	$2.10-2.20

LUBRICATING OILS

Mid-Continent (Group 3): 150-160 bright stock, solvent refined, 0-10 p.p., 95 v.i.	24
200 vis. neutral oil, solvent refined, 0-10 p.p., 95 v.i.	20.75
Pennsylvania Grade: 145-155 vis. at 210, bright stock, 8 color, 25 p.t.	26
200 vis. neutral (180 at 100°), 25 p.t.	23

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.	Mid-Cont.*	Gulf Coast Tex.†	West Tex.‡ N.M.	Wyo. (sour)
14-14.9	$2.02	....	....	....	....
15-15.9	2.08	....	....	....	....
16-16.9	2.13	....	....	....	....
17-17.9	2.19	....	....	....	....
18-18.9	2.24	....	....	....	....
19-19.9	2.30	....	....	....	....
20-20.9	2.35	$2.50	....	$2.37	....
21-21.9	2.41	2.52	....	2.39	....
22-22.9	2.47	2.54	....	2.41	....
23-23.9	2.52	2.56	....	2.43	....
24-24.9	2.58	2.58	$2.91	2.45	....
25-25.9	2.64	2.60	2.93	2.47	$2.13
26-26.9	2.69	2.62	2.95	2.49	2.19
27-27.9	2.76	2.64	2.97	2.51	2.24
28-28.9	2.83	2.66	2.99	2.53	2.29
29-29.9	2.91	2.68	3.01	2.55	2.34
30-30.9	2.97	2.70	3.03	2.57	2.39
31-31.9	3.04	2.72	3.05	2.59	2.44
32-32.9	3.12	2.74	3.07	2.61	2.48
33-33.9	3.20	2.76	3.09	2.63	2.52
34-34.9	3.27	2.78	3.11	2.65	2.56
35-35.9	3.34	2.80	3.13	2.67	2.60
36-36.9	3.39	2.82	3.15	2.69	2.64
37-37.9	....	2.84	3.17	2.71	2.66
38-38.9	....	2.86	3.19	2.73	2.68
39-39.9	....	2.88	3.21	2.75	2.70
40 and up	....	2.90	3.23	2.77	2.72

*Includes Oklahoma, Kansas, North Dakota, West Texas (sweet), North Central Texas, North Louisiana, Arkansas. †Low-cold-test Gulf Coast. ‡Sour.

Effective dates: California, February 7, 1956; east of California, June 15, 1953; Pennsylvania Grade, May 16, 1956.

FLAT PRICES

Louisiana:	
Cotton Valley (distillate)	$3.00
Cotton Valley (Holloway crude)	2.95
Texas:	
East Texas	2.90
Chapel Hill	2.83
Conroe	3.13
Van	2.73
Pennsylvania Grade:	
Bradford	4.45
Middle District	4.32
Southwest Pennsylvania	4.03
West Virginia	3.91
Buckeye Grade	3.85
Zanesville Grade	3.10
★ **Illinois Basin**	**2.90-3.00**
Canada:	
Leduc-Woodbend (flat prices D-2, D-3)	2.60
Redwater (Alta.) D-3	2.49
Smiley-Viking (Sask.)	2.26
Fosterton (Sask.)	1.29
Pembina	2.52

FOREIGN

Venezuela:	
Cumarebo, 48°-49.8°, Tucupido	*3.40
San Joaquin, 41°-41.9°, Puerto La Cruz	*3.04
Oficina, 35°-35.9°, Puerto La Cruz	*2.80
Tia Juana medium, 26.5°-26.9°, Amuay	‡2.30
Quiriquire, 16.5°-16.9°, Caripito	‡2.21
Lagunillas heavy, flat, Amuay or Las Piedras§	2.05
Bachaquero, 16.5°-16.9°, Amuay or Las Piedras§	‡1.90

*Plus or minus 2 cents per barrel for each degree gravity change. †Plus or minus 2.5 cents per barrel for each half-degree gravity change. ‡Plus or minus 3.5 cents per barrel for each half-degree gravity change. §Also available at La Salina at 3.0 cents per barrel less.

Middle East, Persian Gulf (cargoes, f.o.b. lifting port):	
Arabian, 36.0°-36.9°, Ras Tanura	$1.97
Iranian, 34.0°-34.9°, Bandar Mashur	1.91
Iranian, 34.0°-34.9°, Abadan	1.86
Iraq, 36.0°-36.9°, Fao	1.87
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.72
Qatar, 39.0°-39.9°, Umm Said	2.06
Middle East, E. Mediterranean:	
Arabian, 36.0°-36.9°, Sidon	2.46
Iraq, 36.0°-36.9°, Tripoli, Banias	2.46
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°-38°	2.60

TANKER RATES (PER LONG TON)

(Latest reported spot fixtures)

N.W.I.-U.S.N.H., clean (USMC+62.5%)	$4.39
N.W.I.-U.S.N.H., dirty (USMC+42.5%)	3.85
N.W.I.-U.K., dirty (Scale+97.5%) (64s. 2d.)	9.00
Gulf-U.K., dirty (MOT+90%) (72s. 2d.)	10.13
P.G.-U.S.N.H., dirty (USMC+45%)	18.42
P.G.-U.K., dirty (Scale+115%) (116s. 3d.)	16.31

Index of Journal Manuals, Reprints, Maps and Chart

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Title	Price
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Engineering Fundamentals in Modern Drilling	1.00
Engineering Fundamentals on Petroleum Reservoirs	2.00
Fundamentals of Electric Logging	1.50
Hydraulic Fracturing	1.00
Instrumentation	1.00
Oil Well Pumping Methods	1.00
Process Techniques for H_2S Extraction-Sulfur Manufacture	1.00
Pumps, Fans and Blowers	1.00
Secondary Recovery	1.00
Water Flooding-Design and Operation	1.00
Water Flooding-Theory and Practice	1.00
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Experienced in
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Send complete resume to

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Graduate Mechanical Engineer with minimum of three years experience in oil refinery engineering. Must be capable of performing general refinery engineering work and aid in development of design specifications for refinery processing equipment.

Duties will be closely integrated with operations of new independent refinery which includes crude distillation, catalytic cracking, polymerization, coking and utilities.

Send complete résumé of education and experience, including salary requirements. All replies confidential.

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ENGINEERS WANTED: By crude oil pipe line operating company for general engineering. Applicants must have recognized degree in civil, electrical, mechanical, chemical, petroleum or industrial engineering. Experience not essential. Salary based on experience and qualifications. When making application, please furnish resume of experience record, personal data, and copy of college transcript. Reply to—EMPLOYEE RELATIONS DEPARTMENT, Interstate Oil Pipe Line Company, P. O. Box 1107, Shreveport, Louisiana.

VALUATION ENGINEER

Oil Company seeking to purchase producing oil properties desires services of petroleum engineer with experience in reservoir valuation and appraisal work. In addition to practical technical knowledge and experience, must have ability to make and develop contacts. Some experience in the ABC economics of financing purchases also desirable. This is a permanent salaried position with excellent opportunities for growth. Written reply should furnish details on education, experience, age, personal and professional references, and some idea of salary requirements. Small recent photo would be helpful.

Box J-528, The Oil and Gas Journal, Tulsa, Oklahoma.

w

DRILLING ENGINEER

Major drilling company has opening in its general offices for young graduate petroleum engineer to work with manager of operations. Age limit 35. Must have field experience in Mid-Continent areas and be familiar with drilling techniques and machinery. In replying give past employment record, experience, and education. All replies confidential.

Box J-574,
The Oil and Gas Journal,
Tulsa, Oklahoma.

REFINERY OPERATORS

With minimum 7 years' oil refining experience. Must have experience on process units, such as crude distillation, thermal reforming, fluid catalytic cracking and reforming and thermal cracking. For refinery operation in Saudi Arabia.

Write outlining personal history and work experience.

Recruiting Supervisor, Box 136

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PETROLEUM ENGINEERS

Graduate Petroleum Engineers with 2-6 years' experience wanted by Major Oil Company for work in Mid-Continent and Gulf Coast areas. Openings available for Reservoir and Field Production Engineers. In first reply give resume of experience, date available, and salary expected.

BOX J-479, THE OIL AND GAS JOURNAL, TULSA, OKLAHOMA.

HELP WANTED

INDEPENDENT REFINER in Mid-Continent area has opening for Assistant Plant Superintendent. Prefer graduate engineer with minimum of 5 years experience in the operation of vacuum and atmospheric distillation equipment. Box J-543, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEERS

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With degree in Physical Chemistry or Chemical Engineering plus 5 years' petroleum production engineering experience which should include 2 years' study of reservoir fluid behavior.

Salaries commensurate with training and experience. Write outlining personal history and work experience. Please include telephone number.

Recruiting Supervisor, Box 116

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505 PARK AVENUE

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Box J-575,
The Oil and Gas Journal,
Tulsa, Oklahoma.

HELP WANTED

ENGINEER with a minimum of two years electric log experience wanted by oil reserve section of major oil company. Replies should furnish complete personal data, education, experience and starting salary desired. Box J-563, The Oil and Gas Journal, Tulsa, Oklahoma.

Petroleum Geologists

Established Oil Company desires geologists for employment in West Texas area. Must know area and have four to six years of active experience in subsurface mapping and interpretation. Excellent opportunity for advancement. Salary will be commensurate with ability and experience. Reply should state age, education, experience, and salary desired.

BOX J-485,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

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OPENINGS also for petroleum, mechanical & chemical engineers for work in drilling, pipeline & gas depts. Salary commensurate with experience.

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Box J-584, The Oil and Gas Journal,
Tulsa, Oklahoma.

HELP WANTED

GEOPHYSICIST for review interpretation and supervision of seismic work for integrated oil company at permanent location. Please summarize education and experience background in first letter. Salary commensurate with experience. Box J-580, The Oil and Gas Journal, Tulsa, Oklahoma.

MECHANICAL OR Chemical Engineers: Immediate openings for recent college graduates, mechanical or chemical engineering, for training in refinery engineering including inspection, staff and supervisory work in plant maintenance and construction. Excellent employee benefits program. Address letter stating education, experience, and salary requirements to Personnel Division, Continental Oil Company, Ponca City, Oklahoma.

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Construction ENGINEERS

FOREIGN EMPLOYMENT

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Recruiting Supervisor, Box 152

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SITUATIONS WANTED

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EXPLORATION GEOLOGIST—Over 8 years experience in Mid-Continent and Rocky Mts., desires employment. Family man. Resume upon request. Box J-555, The Oil and Gas Journal, Tulsa, Oklahoma.

SEISMOLOGIST with twenty years experience desires geophysical work in Texas with oil company exploration department. Box J-557 The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ECONOMIST - Statistician, B.A., 32, 3 years experience with major, desires responsible position domestic or overseas. Box J-563 The Oil and Gas Journal, Tulsa, Oklahoma.

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GEOPHYSICIST: 18 years experience in all active areas. Masters degree in physics, mathematics geology. Desires position with small company or active independent on interest basis. Mid-Continent location preferred. Box J-559, The Oil and Gas Journal, Tulsa, Oklahoma.

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GEOLOGIST—Age 30, six years experience with major oil company, B.S. and M.S. degrees in petroleum geology. Experience in West Texas and Southeastern States. Married. Want job with progressive oil company or operator offering opportunity. Box J-581, The Oil and Gas Journal, Tulsa, Oklahoma.

YOUNG GEOLOGIST desires change of location, preferably foreign, in surface or subsurface work. Two years experience in South West with Major Oil Co. Married one child. Box J-586, The Oil and Gas Journal Tulsa, Oklahoma.

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BOX J-585,
THE OIL AND GAS JOURNAL,
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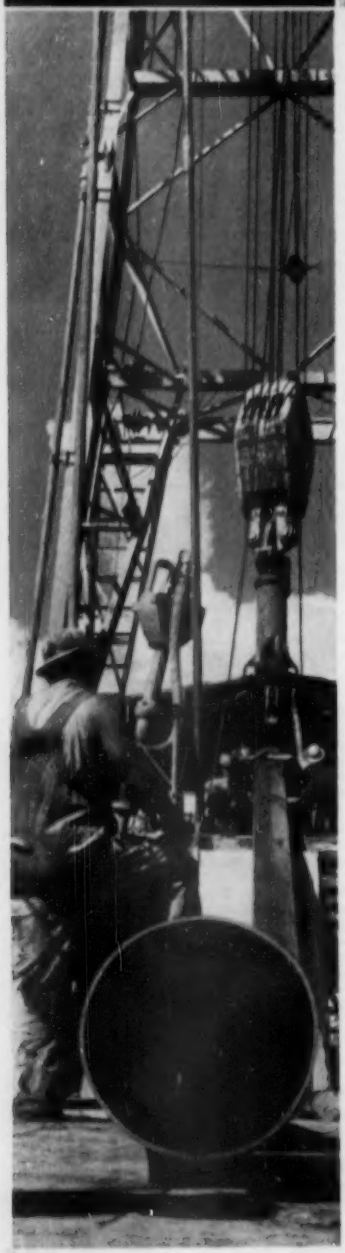

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One carload = 2000′ of 13⅜″ Dia. Armco Casing

F. O. B. mill savings on Armco = $72.82 per 100′ = per carload $1456.40

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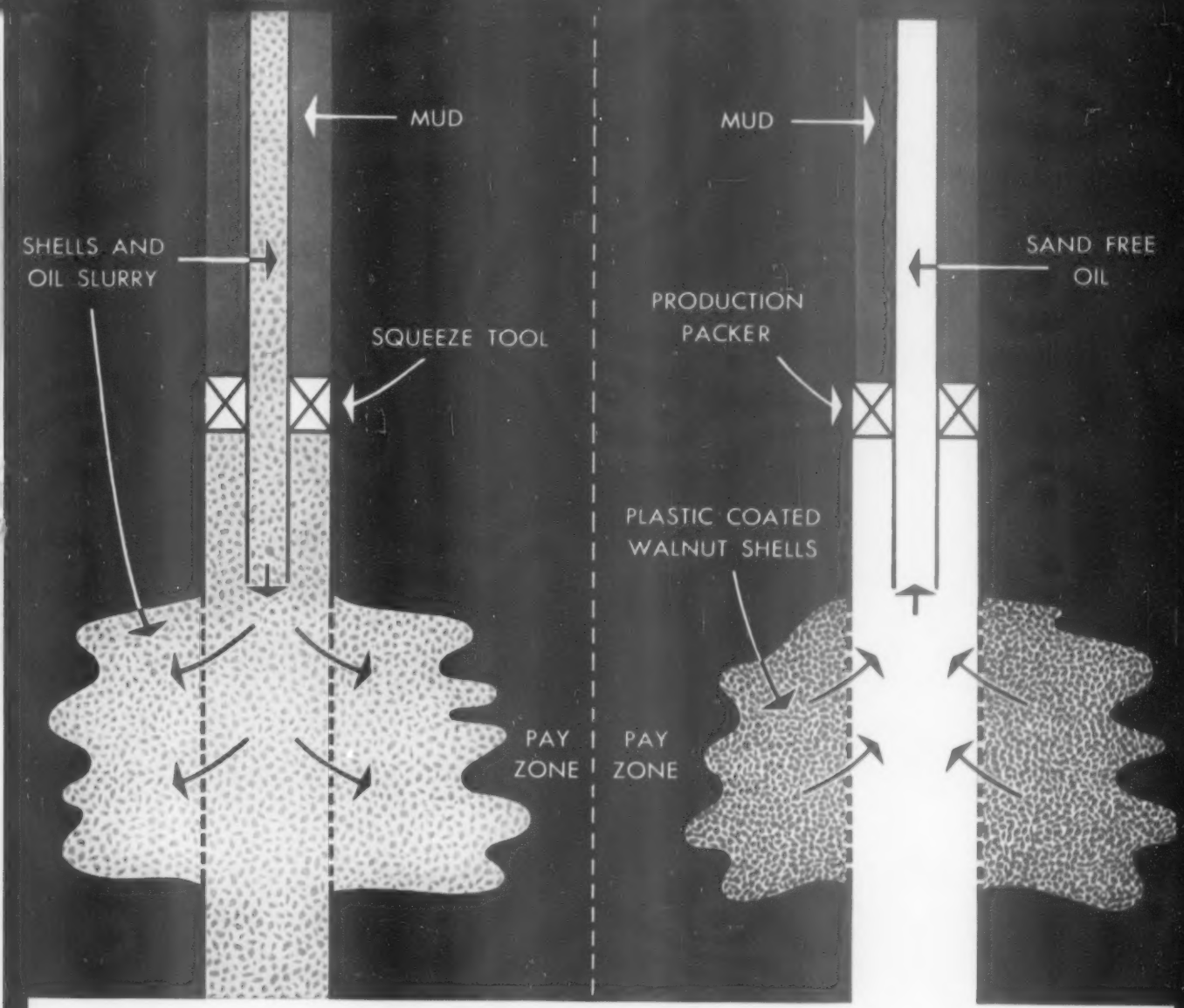

1. *Plastic coated walnut shells in oil are injected under pressure into loose sand formation.*

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Sandlock*, the newest method for blocking unconsolidated sands, employs walnut shells and plastic to form a tough, permeable wall.

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Even though Sandlock service has had great success since its introduction, Dowell has continued to make improvements. These are just a few: (1) a new acid flash-setting technique—cuts downtime considerably; (2) jelled diesel oil can now be used as the carrying fluid—returns to well bore faster; (3) no permanent liners are needed—eliminates costly fishing; (4) walnut shells are pushed back into formation for freer oil flow—provides larger drainage area.

For more information or service, call any of the 165 Dowell offices in the United States and Canada; in Venezuela, contact United Oilwell Service. Or write to Dowell, Incorporated, Tulsa 1, Oklahoma, Department F-11.

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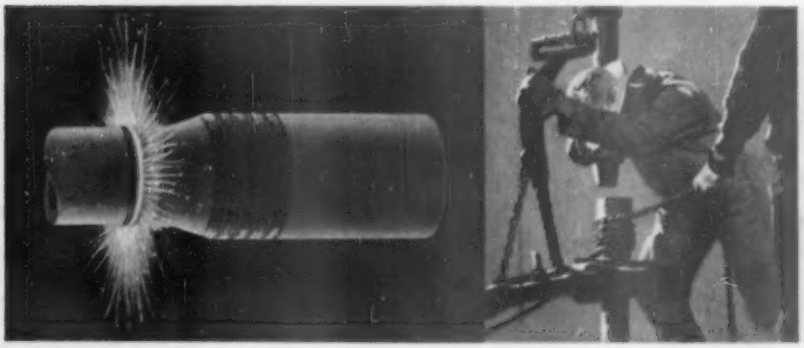

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WEST CAMERON AREA
EAST CAMERON
VERMILION
2
Miocene
Trend
1
Offshore
SHIP SHOAL
SOUTH MARSH ISLAND AREA
EUGENE ISLAND

REFINERIES

Operating Company	Plant Loc.	Cap., Bbl./Day
Atlas Processing Co.	Shreveport	17,500

GASOLINE PLANTS

Operating Company	Plant Loc.	Cap., Gal./Day
Claiborne Gasoline Co.	Lisbon	130,000
United Gas Pipe Line Co.	Vivian	50,000

PETROCHEMICAL PLANTS

Operating Company	Plant Loc.	Products
Atlas Processing	Shreveport	Benzene

REFINERIES

Operating Company	Plant Loc.	Cap., Bbl./Day
Cit-Con Oil Corp.	Lake Charles	36,000
Cities Service Ref.	Lake Charles	180,000
Continental Oil	Westlake	51,100
Evangeline Ref.	Jennings	2,000

GASOLINE PLANTS

Operating Company	Plant Loc.	Cap., Gal. Day
Continental Oil Co.	Gillis	86,954

PETROCHEMICAL PLANTS

Operating Company	Plant Loc.	Products
Continental Oil	Westlake	Benzene, toluene, propylene tetramer
Petroleum Chem.	Lake Charles	Butadiene

REFINERIES

Operating Company	Plant Loc.	Cap., Bbl./Day
Esso Standard Oil Co.	Baton Rouge	343,000

GASOLINE PLANTS

Operating Company	Plant Loc.	Cap., Gal./Day
Continental Oil Co.	Ville Platte	57,315
Humble Pipe Line Co.	St. Landry	59,340

PETROCHEMICAL PLANTS

Operating Company	Plant Loc.	Products
Copolymer	Baton Rouge	Butadiene
Esso Standard Oil	Baton Rouge	Ethylene, propylene, butyl rubber, etc.
Foster-Grant	Baton Rouge	Styrene
U. S. Rubber	Baton Rouge	Styrene-resin-nitriles

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Shell Oil Co.	Norco

PETROCHEMICAL

Operating Company	Plant Loc.
American Cyanamid	Avondale
Commercial Solvents	Sterlington
Oronite Chemical	Oak Point
Shell Chemical	Norco

FACTS ABOUT LOUISIANA OIL & GAS (5-'56)

	OIL					GAS			
	NO. PROD. WELLS	DAILY PRODUCTION		CUM. PROD. Bbls. 1-'56	RESERVES (1,000's bbls.)	NO. PROD. WELLS	DAILY GAS PROD. Mcf.	P	. CUM. D. 1-'56	RESERVES (bill. c.f.)
		CRUDE	CONDENSATE							
NORTH LOUISIANA	10,020	129,850	9,050	1,032,556,451	718,000	3,000	1,469,000	1	0,000,000	14,835
SOUTH LOUISIANA	8,875	518,000	60,900	2,662,449,918	1,650,000	1,700	2,800,000	4	0,000,000	26,200
OFFSHORE	405	101,100	2,600		1,500,000		250,000			1,400
TOTAL	19,300	748,950	72,550	3,695,006,369	3,868,000	4,700	4,519,000	15	0,000,000	42,435

Journal-guide to...

LOUISIANA

HIGHLIGHTS OF THE OIL AND GAS INDUSTRY

Supplement to The Oil and Gas Journal, Vol. 54, No. 59.
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STRATIGRAPHY AND STRUCTURES . . . .

KEY TO NEW LOUISIANA OIL

1—Offshore . . . Gravity and seismic surveys have proved very effective in mapping new oil fields, because oil traps offshore are directly related to salt movement. The principal producing zones are numerous sands in the Tertiary section, most of them Miocene in age. The Miocene section thickens seaward toward the axis of the Gulf Coast geosyncline. The sands are particularly well-developed in the vicinity of the present Mississippi delta where an intense drilling campaign is now in progress.

2—Miocene Trend . . . Sand trends serve to localize production in South Louisiana, although the main trapping element has been salt movement. Invariably production is related to salt domes on the Miocene trend, either the piercement type or the deep-seated where salt is presumed to underlie the producing structure.

Salt domes offer innumerable possibilities for production. On the crest of the piercement domes, oil can be trapped in the overlying sediments. The caprock that occurs directly above the salt also produces. On many domes, the salt plug is inclined or bulges, and production is found in the sands below the bulge or overhang. At Cote Blanche, wells have penetrated as much as 12,000 ft. of salt and still produced below the overhang.

Complex faulting nearly always accompanies salt movement and is an important factor in trapping oil on the flanks of the salt domes. Laboratory experiments show that the salt movement affects a large area surrounding the dome, and the successful drilling on the flanks of the known salt domes confirms the theory.

3—Oligocene Trend . . . Faulting, salt movement, and stratigraphy play important roles along South Louisiana's Marginulina-Frio or Oligocene trend. Salt domes, both piercement and deep-seated, produce, and the faulting is the normal or gravity type. Some of the fault trends are almost regional in extent and can be traced for many miles.

Experience has shown that subsurface studies and the seismograph combine to form the best method for mapping new oil fields. Frequently the oil trap is closure against a "down-to-the-coast" fault with production on the coastward side of the fault. The deep-seated salt domes are faulted and production on these occurs in the fault segments and on the crest of the structure in the graben.

4—North Louisiana . . . Two structural features have helped control oil production in North Louisiana, the Sabine uplift and the Monroe uplift. Of these, the Sabine is the more important and oil exploration has been concentrated on its flanks, particularly during the last ten years. Reservoir conditions do not appear as favorable to the east in the vicinity of the Monroe uplift and this is evident by the paucity of large oil fields on its flanks. However, many important oil fields lie either on the flanks of these two uplifts or in the basin that exists between them.

Along the state line is a fault trend on which are located several oil fields; Haynesville and East Haynesville fields are two of the largest on this trend.

Frequently North Louisiana has been referred to as the Interior Salt Dome Basin, although to date no commercial production has been found on the known piercement domes. However, nearly all the North Louisiana structures that produce are related to deep-seated salt movement.

In North Louisiana, facies plays an important role in production. The oil normally occurs within a marine facies or where the marine and continental facies interfinger. This is a very important concept since the facies may not overlap. That is, a marine Cotton Valley section usually will not directly underlie a marine Travis Peak section. Similarly, the deep Smackover production does not coincide with the areas of well-developed Cotton Valley blanket sands.

In the southeastern part of North Louisiana, the Wilcox sands are important reservoirs. These are erratic, lenticular sands that produce both on and off structure. Many of the pools are stratigraphic traps and more often than not are small in areal extent.

NEW DEVELOPMENTS IN REFINING

Company	Loc. of Ref.	Type of Project	Cap. or Prod. Rating (B/D)
Bay Petroleum	Chalmette	Adding Crude Cap.	4,000
		Adding Vacuum Cap.	1,600
		Adding Visbreaker Cap.	1,600
		Building F. C. C.	12,000
		Building Platformer	5,000
Continental Oil	Westlake	Adding T. C. C. Cap.	7,000
Ingram Oil & Ref.	Mereaux	Adding Crude Cap.	2,000
		Adding Vacuum Cap.	1,000
		Building Platformer	3,000
Shell Oil Co.	Norco	Bldg. Thermal Reformer	4,000

NEW DEVELOPMENTS IN GASOLINE PLANTS

Gulf Natural Gas Corp. --Has under construction a plant near Shreveport, La., to process gas from about 2,200 wells. The plant will have a daily capacity of 27,000,000 cu. ft. of natural gas.

Tide Water Associated, --Delta Engineering Corp., of Houston, is building a new plant for Tide Water at Venice field, Plaquemines Parish, near Venice, La.

NEW DEVELOPMENTS IN PETROCHEM PLANTS

Company	Plant Loc.	Type Project	Capacity
Continental Oil	Gretna	Sulfonates; Petrolatums	
Dow Chemical	Baton Rouge	Organic Chemicals	
General Petroleum	Lake Charles	Anhydrous Ammonia	100,000 tons/yr.
Grace Chemical	Baton Rouge	Polyethylene	50,000,000 lb/yr.
MidSouth Chemical	Lake Charles	Ammonia Unit	
Monsanto	Luling	Adipic-Acid Unit	
Petroleum Chemicals	Lake Charles	Butadiene Exp.	79,000 tons/yr.
Shell Chemical	Norco	Hydrogen Peroxide	
U. S. Rubber	Baton Rouge	Petrochemicals	
Wyandotte Chemical	Baton Rouge	Ethylene Oxide; Glycol	

NEW DEVELOPMENTS IN PIPELINES

Crude-Oil

Offshore Gathering Corp. (Houston)--Proposes natural-gas and crude-oil lines, each about 364 miles, in Gulf of Mexico off Louisiana.

Natural Gas

American Louisiana Pipe Line Co. --Building 1,160-mile line from North Tepetate, La., to Detroit.

Arkansas Louisiana Gas Co. --Has long-range plans for large line from Texas-Louisiana coastal region to northern Louisiana.

Colonial Natural Gas Corp. --Proposes system between Houston-Lake Charles area and Miami, Fla.

Houston Texas Gas & Oil Co. --Applied to FPC for 960-mile system between Baton Rouge and Miami.

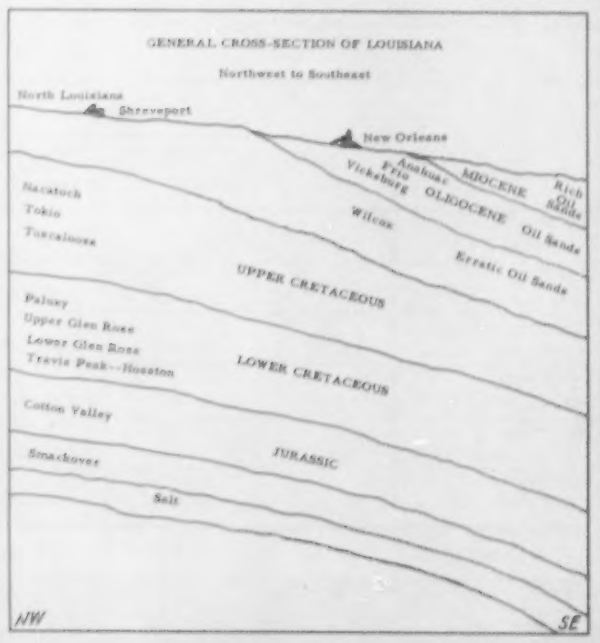
Tennessee Gas Transmission Co. --192 miles of 24-in., 34 miles of 20-in., 15 miles of 18-in., 110 miles of 4, 6, 8, 10, and 12-in. laterals to extend gathering system from west of Crowley, La., to tie in to Tennessee Gas eastward across southeast Louisiana offshore areas.

Texas Gas Transmission Corp. --Plans 110-mile, 20-in. from Assumption Parish to near Eunice, La.

Transcontinental Gas Pipe Line Corp. --Has applied to FPC to lay 160 miles of 36-in., and 68 miles of 30-in. loops from Louisiana to Pennsylvania.

TOTAL LEASES IN OFFSHORE AREAS

Company or Companies	Total Acres
Anderson-Prichard Oil Corp.	15,571
British American, Seaboard, et al	3,513
The California Co.	181,936
California-Shell	7,864
Callery	792
Continental-Atlantic-Tide Water-Cities Service	354,924
Cities Service-Skelly	1,250
Forest Oil Corp.	15,000
Forest et al	5,000
Forest-Signal	4,835
Gulf Refining Co.	119,297
Gulf-Humble	37,360
House, A. F.	1,000
Humble Oil & Refining Co.	163,479
Hunt Interests	11,562
Kerr-McGee-Union of Calif.	11,667
Lee, Ray	25,000
Magnolia Petroleum Co.	9,555
Magnolia-Continental-Newmont	178,977
Mecom, John	21,206
Ocean Drilling & Exploration Co.	2,500
Phillips Petroleum Co.	75,423
Phillips-Gulf	11,884
Phillips-Kerr-McGee	59,559
Placid Oil Co.	16,495
Pure Oil Co.	53,750
Pure-Sun-Superior	2,511
Seaboard Oil Co. et al	2,411
Shell Oil Co.	175,638
Shell et al	8,150
Sinclair et al.	37,018
Skelly-Sunray Mid-Continent	5,816
Stanolind Oil & Gas Co.	42,499
Standard-Phillips-Kerr-McGee	25,000
Stanolind-Placid	5,000
Sun Oil Co.	22,358
Sun-Ohio-Pure	10,000
Superior Oil Co.	71,717
Superior-J. Ray McDermott	6,787
Superior-Pure	567
The Texas Co.	53,136
Texas-Stanolind	27,500
Texas-Stanolind-Mecom	3,228
Union Oil Co. of Calif.	10,938
Union of Cal.-Stanolind	7,500
Union Producing Co.	12,273
Union Producing-Shell	2,500
Zachary, H. B.	1,250



STRATIGRAPHY AND STRUCTURE . . . .

KEY TO NEW TEXAS OIL

1. **Texas Panhandle** . . . This is now one of the most active drilling areas in the state. Recent discoveries of Pennsylvanian oil and gas reservoirs in the Anadarko basin have stimulated the campaign. Oil has also been discovered in the Dalhart basin, and in the deeper rocks flanking the Amarillo uplift. The large Palo Duro basin south of the uplift is relatively unexplored. These developments and potential drilling targets indicate great activity here in the next few years.

2. **Midland Basin** . . . Recent years have seen much deep drilling in this, the largest structural component of the Permian basin province. Successes in pre-Permian formations such as the Devonian and Ordovician (Ellenburger) have encouraged the deeper search. The east Spraberry field and its development touched off a brisk drilling spree in the center of the basin, and while it has now abated, the probing of the pre-Permian section in a search for deeply buried oil pools continues at a rapid rate, and with widespread success.

3. **Delaware Basin** . . . This huge asymetrical basin is the westernmost portion of the Permian basin province. It has yielded many shallow Permian oil pools, but geologists believe it harbors as much or more pre-Permian oil than the Midland basin to the east. The difficulty is that the same prospective oil rocks here lie deeply buried, at 20,000 ft. or more. Seismic exploration is thwarted by a thick mantle of Permian sediments. The deepest test in the basin stopped at 18,609 ft., still in Pennsylvanian rocks. The basin remains a potent drilling target for future years.

4. **Central Basin Platform** . . . This is a peninsula-like subsurface topographic feature 150 miles long and 45 miles wide. It separates the Midland basin on the east from the Delaware basin on the west. On its flanks and along its crest, some of the most prolific oil fields in the world have been found, with flows coming principally from sands and limestones of Permian age. Recently, a drilling program all along its eastern flank has paid off handsomely with deep production from Devonian and Ordovician. Now, a similar search is beginning along the western edge, and preliminary successes point to a greatly accelerated drilling campaign there.

5. **Red River Uplift and Bend Arch** . . . The Red River uplift is a chain of buried granite mountains. In the Paleozoic rocks that lie above it and on its flanks, hundreds of individual oil pools have been discovered. Exploration now is aimed at deeper horizons and continues to be successful. On the Bend arch, drilling activity is still brisk, even though the region has been drilled to a high density. Deeper structures and deeper pays, as well as shallower reef and stratigraphic traps, continue to reward the oilfinder.

6. **Central Texas Fault Zones** . . . Two principal lines of faulting slash across the state and divide the Gulf Coastal plain from the regions to the west. These are the Balcones fault system, and to the east, a subsidiary system, the Luling-Mexia-Talco faults. Along the latter fault line, prolific oil fields have been found in Lower Cretaceous rocks. Today, the fault zone is as active as ever in drilling, as new fields are discovered in shallower formations.

7. **Southwest Texas** . . . Area is dominated by three structural units: the Miranda shoreline trend, the Vicksburg flexure and fault zone, and the Rio Grande embayment. Hundreds of oil fields here produce from Tertiary sands, and every field contains several pays. Drilling today is aimed at deeply buried reservoirs, stratigraphic traps, and newly-found offshore domes.

8. **Upper Gulf Coast** . . . The predominant structural factor is the salt dome. While it is believed that all onshore domes have been found, a number of new ones have been spotted in offshore waters, and Texas' offshore campaign is just getting underway. Onshore, Gulf Coast operators continue to find new pools on the flanks of the older salt dome structures, and this type of exploration will continue for many years to come.

9. **East Texas Embayment** . . . Most production comes from Upper Cretaceous sands, especially the Woodbine. But new fields now are being discovered in the deep Lower Cretaceous-Trinity sands and in the Jurassic-Smackover. It is an area that offers every known type of structural trap, including 16 nonproductive piercement salt domes. The embayment is far from completely explored. The Sabine uplift, on the Texas-Louisiana line, terminates the embayment to the east, and its flanks have yielded some of the state's largest gas fields.

REFINERIES

Operating Company	Plant Loc.	Cap., Bbl./Day
Phillips Petroleum	Phillips	71,000
Shamrock Oil & Gas	Sunray	15,500
The Texas Co.	Amarillo	15,500

GASOLINE PLANTS

Operating Company	Plant Loc.	Cap., Gal./Day
Colo. Interstate Gas	Fourway	85,000
Colo. Interstate Gas	Bivins	55,000
Nat. Gas P.L. of America	Fritch	85,662
Nat. Gas P.L. of Amer.	Stinnett	84,657
Phillips Petroleum	(11 plants)	1,150,000
Shamrock Oil & Gas	Sunray	198,000
Shelly Oil Co.	Carson-Gray	315,000

PETROCHEMICAL PLANTS

Operating Company	Plant Loc.	Products
Carbide & Carbon	Pampa	Methanol, acetone, acetic acid, etc.
Phillips Chemical	Borger	Butadiene, methyl butenes.

REFINERIES

Operating Company	Plant Loc.	Cap., Bbl./Day
Continental Oil	Wichita Falls	9,000
Panhandle Oil	Wichita Falls	7,000
Premier Oil Ref.	Fort Worth	8,000
Tydal Co.	Gainesville	2,000

GASOLINE PLANTS

Operating Company	Plant Loc.	Cap., Gal./Day
Continental Oil	K.M.A.	63,929
Lone Star Producing	Ranger	60,000

PETROCHEMICAL PLANTS

Operating Company	Plant Loc.	Products
Petrocarbon Chem.	Irving	Benzene, toluene.

REFINERIES

Operating Company	Plant Loc.	Cap., Bbl./Day
Cal-Tex Refining	Colorado City	12,000
Cosden Petroleum	Big Spring	28,500
Monarch Refining	San Antonio	2,500
Onyx Refining	Abilene	6,500
Phoenix Refining	San Antonio	3,500
Std. Oil Co. of Tex.	El Paso	38,000
The Texas Co.	El Paso	13,000
Wichett Refining	Wichett	4,900

GASOLINE PLANTS

Operating Company	Plant Loc.	Cap., Gal./Day
El Paso Nat. Gas	Spraberry	208,033
Lion Oil Co.	Diamond M	70,000
Magnolia Petroleum	Pegasus	65,997
Odessa Nat. Gaso.	S. Cowden-Foster	50,000
Phillips Petroleum	(7 plants)	1,412,000
Pure Oil Co.	Dollarhide	105,000
Reef Fields Gaso.	Big Spring	60,000
Sid Richardson	Keystone	75,000
Shell Oil Co.	TXL	83,000
Shell Oil Co.	Wasson	173,000
Stanolind Oil & Gas	(7 plants)	582,000
Sunray Mid-Continent	Kelly-Snyder	119,000
Texas Nat. Gaso.	(4 plants)	675,000

PETROCHEMICAL PLANTS

Operating Company	Plant Loc.	Products
Cosden Petroleum	Big Spring	Benzene, toluene
Phillips Chemical	Big Spring	p-Xylene

REFINERIES

Operating Company	Plant Loc.
American Oil Co.	Texas City
Crown Central Pet. Co.	Pasadena
Eastern States Pet. Co.	Houston
Humble Oil & Ref. Co.	Baytown
Phillips Petroleum Co.	Sweeny
Republic Oil Ref. Co.	Texas City
Shell Oil Co.	Houston
Sinclair Refining Co.	Houston
Texas City Ref., Inc.	Texas City
Texas Gas Corp.	Winnie

GASOLINE PLANTS

Operating Company	Plant Loc.
Humble Oil & Ref. Co.	Conroe
Phillips Petroleum Co.	Alvin
Shell Oil Co.	Provident City
Southern Production Co.	Pledger
Texas Gas Corp.	Winnie

REFINERIES

Operating Company	Plant Loc.
Corpus Christi R.	Corpus Christi
Danciko Refining	Petfus
Delhi-Taylor Oil	Corpus Christi
Delhi-Taylor Oil	Port Isabel
Matagorda Corp.	Bay City
McBride Refining	Brownsville
McBride Refining	La Blanca
Pontiac Refining	Corpus Christi
Sinclair Refining	Corpus Christi
Southwestern Oil	Corpus Christi
Suntide Refining	Corpus Christi

GASOLINE PLANTS

Operating Company	Plant Loc.
Goliad Corp.	Sheridan
Matagorda Corp.	Bay City

PETROCHEMICAL PLANTS

Operating Company	Plant Loc.	Product
Carbide & Carbon	Seadrift	Polyeth
Carbide & Carbon	Bishop	Methan pentae
E. I. du Pont	La Porte	Carbon
E. I. du Pont	Victoria	Adipon
Hidalgo Chemical (plant rebuilding)	Brownsville	Acetal Isobut
Pure Oil	Smiths Bluff	Petrol
Sinclair Chemicals	Corpus Christi	Aroma
Suntide Refining	Corpus Christi	Propyl

FACTS ABOUT TEXAS OIL AND GAS (3-'56)

	OIL				GAS			
	NO. PROD. WELLS	DAILY PRODUCTION	CUM. PROD. Bbls. 1-'56	RESERVES (1000's bbls.)	NO. PROD. WELLS	DAILY GAS PROD. Mcf.	DAILY PROD. CONDENSATE	RESERVES (bill. c.f.)
EAST TEXAS (R.R.C. Dist. 5 & 6)	26,957	382,600	4,381,536,700	2,790,000	1,753	1,628,813	4,819	14,202.5
GULF COAST (R.R.C. Dist. 2 & 3)	17,689	572,100	4,401,779,000	3,278,000	2,909	4,381,251	29,012	34,462.9
SOUTHWEST TEXAS (R.R.C. Dist. 1 & 4)	18,157	291,300	1,829,296,700	1,352,000	1,943	2,344,657	4,553	21,815.7
NORTH TEXAS (R.R.C. Dist. 7-B & 9)	42,298	360,800	2,207,879,800	1,134,000	772	77,607	255	2,765.6
WEST TEXAS (R.R.C. Dist. 7-C & 8)	45,671	1,183,000	4,916,369,412	6,161,000	500	288,405	5,896	14,789.9
PANHANDLE (R.R.C. Dist. 10)	9,584	91,400	846,329,975	430,000	3,916	2,421,811	150	20,153.3
TOTAL TEXAS	160,356	2,881,200	18,583,191,587	15,145,000	11,793	11,142,544	44,685	108,189.9

Gasoline plants listed are 50,000 gal./day and larger

Journal-Guide to...

TEXAS

HIGHLIGHTS OF THE OIL AND GAS INDUSTRY

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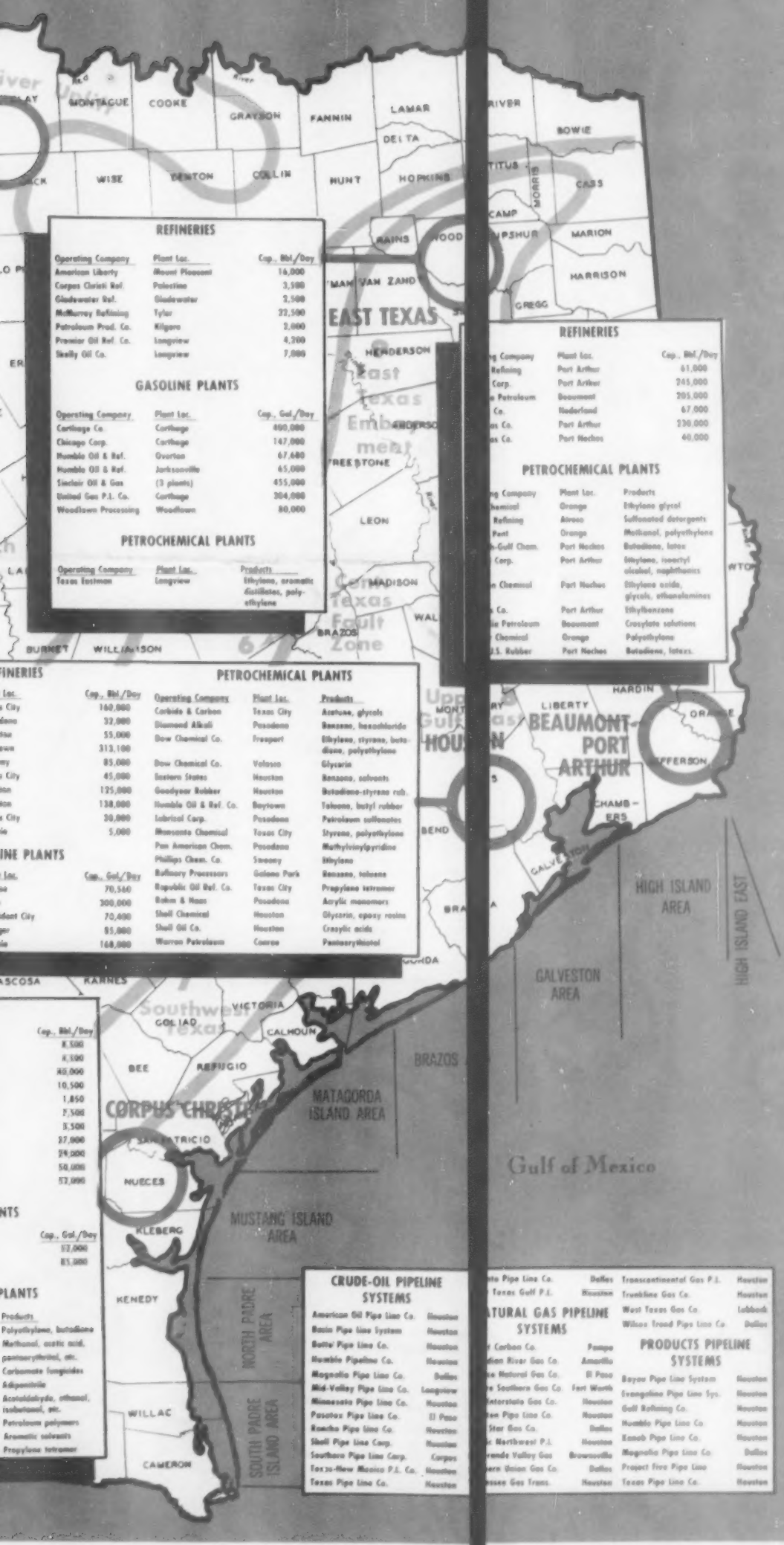

REFINERIES

Operating Company	Plant Loc.	Cap., Bbl./Day
American Liberty	Mount Pleasant	16,000
Corpus Christi Ref.	Palestine	3,500
Gladewater Ref.	Gladewater	2,500
McMurrey Refining	Tyler	22,500
Petroleum Prod. Co.	Kilgore	2,000
Premier Oil Ref. Co.	Longview	4,200
Skelly Oil Co.	Longview	7,000

GASOLINE PLANTS

Operating Company	Plant Loc.	Cap., Gal./Day
Carthage Co.	Carthage	480,000
Chicago Corp.	Carthage	147,000
Humble Oil & Ref.	Overton	67,680
Humble Oil & Ref.	Jacksonville	65,000
Sinclair Oil & Gas	(3 plants)	455,000
United Gas P.L. Co.	Carthage	204,000
Woodlawn Processing	Woodlawn	80,000

PETROCHEMICAL PLANTS

Operating Company	Plant Loc.	Products
Texas Eastman	Longview	Ethylene, aromatic distillates, polyethylene

REFINERIES

Operating Company	Plant Loc.	Cap., Bbl./Day
[illegible] Refining	Port Arthur	61,000
[illegible] Corp.	Port Arthur	245,000
[illegible] Petroleum	Beaumont	205,000
[illegible] Co.	Nederland	67,000
[illegible] Co.	Port Arthur	230,000
[illegible] Co.	Port Neches	40,000

PETROCHEMICAL PLANTS

Operating Company	Plant Loc.	Products
[illegible] Chemical	Orange	Ethylene glycol
[illegible] Refining	Alvaco	Sulfonated detergents
[illegible] Pont	Orange	Methanol, polyethylene
[illegible]-Gulf Chem.	Port Neches	Butadiene, latex
[illegible] Corp.	Port Arthur	Ethylene, isooctyl alcohol, naphthenics
[illegible] Chemical	Port Neches	Ethylene oxide, glycols, ethanolamines
[illegible] Co.	Port Arthur	Ethylbenzene
[illegible] Petroleum	Beaumont	Cresylate solutions
[illegible] Chemical	Orange	Polyethylene
[illegible] U.S. Rubber	Port Neches	Butadiene, latexes

REFINERIES

Company	Loc.	Cap., Bbl./Day
[illegible] Co.	Texas City	160,000
[illegible]	[illegible]	32,000
[illegible]	[illegible]	55,000
[illegible]	[illegible]	313,100
[illegible]	[illegible]	85,000
[illegible] City	[illegible]	45,000
[illegible]	[illegible]	125,000
[illegible]	[illegible]	138,000
[illegible] City	[illegible]	30,000
[illegible]	[illegible]	5,000

PETROCHEMICAL PLANTS

Operating Company	Plant Loc.	Products
Carbide & Carbon	Texas City	Acetone, glycols
Diamond Alkali	Pasadena	Benzene, hexachloride
Dow Chemical Co.	Freeport	Ethylene, styrene, butadiene, polyethylene
Dow Chemical Co.	Velasco	Glycerin
Eastern States	Houston	Benzene, solvents
Goodyear Rubber	Houston	Butadiene-styrene rub.
Humble Oil & Ref. Co.	Baytown	Toluene, butyl rubber
Lubrizol Corp.	Pasadena	Petroleum sulfonates
Monsanto Chemical	Texas City	Styrene, polyethylene
Pan American Chem.	Pasadena	Methylvinylpyridine
Phillips Chem. Co.	Sweeny	Ethylene
Refinery Processors	Galena Park	Benzene, toluene
Republic Oil Ref. Co.	Texas City	Propylene tetramer
Rohm & Haas	Pasadena	Acrylic monomers
Shell Chemical	Houston	Glycerin, epoxy resins
Shell Oil Co.	Houston	Cresylic acids
Warren Petroleum	Conroe	Pentaerythritol

LINE PLANTS

[illegible] Loc.	Cap., Gal./Day
[illegible]	70,560
[illegible]	300,000
[illegible]dant City	70,490
[illegible]ger	95,000
[illegible]ie	168,000

NTS

Cap., Bbl./Day
8,500
4,100
40,000
10,500
1,850
7,500
3,500
27,900
24,000
50,000
52,000

NTS

Cap., Gal./Day
52,000
85,000

PLANTS

Products
Polyethylene, butadiene
Methanol, acetic acid, pentaerythritol, etc.
Carbamate fungicides
Adiponitrile
Acetaldehyde, ethanol, isobutanol, etc.
Petroleum polymers
Aromatic solvents
Propylene tetramer

CRUDE-OIL PIPELINE SYSTEMS

American Oil Pipe Line Co.	Houston
Basin Pipe line System	Houston
Butte Pipe Line Co.	Houston
Humble Pipeline Co.	Houston
Magnolia Pipe Line Co.	Dallas
Mid-Valley Pipe Line Co.	Longview
Minnesota Pipe Line Co.	Houston
Pasotex Pipe Line Co.	El Paso
Rancho Pipe Line Co.	Houston
Shell Pipe Line Corp.	Houston
Southern Pipe Line Corp.	Corpus
Texas-New Mexico P.L. Co.	Houston
Texas Pipe Line Co.	Houston
[illegible] Pipe Line Co.	Dallas
[illegible] Texas Gulf P.L.	Houston

NATURAL GAS PIPELINE SYSTEMS

[illegible] Carbon Co.	Pampa
[illegible]ion River Gas Co.	Amarillo
[illegible]e Natural Gas Co.	El Paso
[illegible]e Southern Gas Co.	Fort Worth
[illegible]nterstate Gas Co.	Houston
[illegible]ken Pipe Line Co.	Houston
[illegible] Star Gas Co.	Dallas
[illegible]k Northwest P.L.	Houston
[illegible]rande Valley Gas	Brownsville
[illegible]ern Union Gas Co.	Dallas
[illegible]ssee Gas Trans.	Houston
Transcontinental Gas P.L.	Houston
Trunkline Gas Co.	Houston
West Texas Gas Co.	Lubbock
Wilcox Trend Pipe Line Co.	Dallas

PRODUCTS PIPELINE SYSTEMS

Bayou Pipe Line System	Houston
Evangeline Pipe Line Sys.	Houston
Gulf Refining Co.	Houston
Humble Pipe Line Co.	Houston
Kanab Pipe Line Co.	Houston
Magnolia Pipe Line Co.	Dallas
Project Five Pipe Line	Houston
Texas Pipe Line Co.	Houston

NEW DEVELOPMENTS IN REFINING

Company	Loc. of Ref.	Type of Project	Cap. or Prod. Rating (B/D)
American Oil Co.	Texas City	Hydrodesulfurization	5,000
Atlantic Refining	Port Arthur	Planning Catformer	13,500
		Planning Unifining	13,500
Col-Tex Refining	Colorado City	Building Unifining	1,800
Cosden Petroleum	Big Spring	Building Reformer	1,900
		Polymerization	400
Gulf Oil Corp.	Port Arthur	Adding Crude Cap.	74,400
		Adding Vacuum Cap.	30,000
		Building Fluid Cat.	54,000
		Building Gulfining	40,000
		Add. Sulfuric Alky Cap.	4,500
Humble Oil & Ref.	Baytown	Add. Sulfuric Alky Cap.	1,300
		Adding Lube Cap.	1,400
Magnolia Pet. Co.	Beaumont	Adding Crude Cap.	15,000
		Building T. C. C.	35,800
		Building Sovaforming	25,000
		Planning Sovafining	30,000
		Planning HF Alky	8,000
Phillips Pet. Co.	Sweeny	Adding Crude Cap.	10,000
Pontiac Refining	Corpus Christi	Adding Crude Cap.	5,000
		Building Platforming	5,000
Pure Oil Co.	Nederland	Building Ultraformer	15,000
		Hydrodesulfurization	20,000
Rado Refining	McAllen	Adding Crude Cap.	1,500
Shamrock Oil & Gas	Sunray	Building Platformer	4,000
Shell Oil Co.	Houston	Building Platformer	16,000
		Hydrodesulfurization	16,000
Sinclair Ref.	Houston	Bldg. Sinclair-Baker Reformer	24,000
Southwestern O. & R.	Corpus Christi	Catalytic Reforming	9,000
Standard of Texas	El Paso	Adding Crude Cap.	23,000
Suntide Refining	Corpus Christi	Adding Crude Cap.	13,000
		Adding Vacuum Cap.	3,000
		Adding Fluid Cat.	5,000
Texas Asphalt & Ref.	Pasadena	New Refinery	2,500
Texas Gas Corp.	Winnie	Adding Crude Cap.	7,500

NEW DEVELOPMENTS IN GASOLINE PLANTS

Arkansas Fuel Oil Corp.--Procon, Inc., is building a new 900-bbl. Platforming unit at Arkansas Fuel's Panola plant at Carthage, Tex.

Atlanta Gas Co.--Baird Const. Co., of Tulsa is working on a $500,000 project for Atlanta, in Wise Co., near Bridgeport, Tex.

Atlantic Refining Co.--Atlantic is planning an absorption plant for recovery of propane, butane, and natural gasoline. The plant will be near Crane, Tex.

Honolulu Oil Corp.--Plans to build a plant in Hockley Co., Tex.

Reef Fields Gasoline Corp.--Holder Const. Co. of Snyder, Tex., is building a gas-gathering system extension to Reef Field's East Vealmoor plant. The system is at Jo Mill field, Borden Co., near Big Spring, Tex.

Sinclair Oil & Gas Co.--Has under construction an absorption plant near Eldorado, Tex.

Sun Oil Co.--Adding compressors and additional processing equipment to its plant at Jameson field, Coke Co., near Colorado City, Tex.

Tennessee Gas Transmission Co.--O. L. Olsen Co., of Houston, is building fractionating facilities for Tennessee Gas in Harris Co., near La Porte, Tex.

NEW DEVELOPMENTS IN PETROCHEM PLANTS

Company	Plant Loc.	Type Project	Capacity
Carbide & Carbon	Seadrift	Ethylene Oxide Exp.	200,000,000 lb/yr.
Celanese	Houston	Poly Olefins	40,000,000 lb/yr.
Cosden Petroleum	Big Spring	Styrene Plant	20,000,000 lb/yr.
Diamond Alkali	Houston	Perchlorethylene Exp.	50 per cent
Dow Chemical	Freeport	Inc. Ethylene-Oxide Cap.	30,000,000 lb/yr.
du Pont	Beaumont	Synthetic Rubber	
El Paso Natural	Odessa	Butadiene	137 tons
Firestone	Orange	Butadiene Plant	40,000 tons/yr.
General Tire	Odessa	Copolymer Plant	40,000 tons/yr.
Goodyear Syn. Rubber	Houston	Copolymer Exp.	200,000 tons/yr.
Gulf Oil	Port Arthur	Inc. Ethylene Units	
Kellogg	Houston Area	Polyethylene	
Northeast Texas Chem.	East Texas	Chem. & Fertilizer Plt.	
Petro-Tex Chemical	Houston	Butadiene Exp.	45,000 tons/yr.
Phillips Chemical	Sweeny	Ethylene	329,000 lb.
Phillips Chemical	Pasadena	Polyethylene	501,000 lb.
Phillips Chemical	Phillips	Exp. Copolymer Plt.	126 tons
Phillips Chemical	Phillips	Exp. Butadiene Cap.	90 tons
Rhom & Haas	Houston	Methyl Alcohol	100 tons
Shell Chemical	Houston	Bisphenol Exp.	
Sinclair Refining	Houston	SO3 Sulfonation	
Texas Butadiene & Chem.	Houston	Butylenes & Butadiene	
Texas Eastman	Longview	Inc. Oxo Facilities	

NEW DEVELOPMENTS IN PIPELINES

Crude-Oil

Pasotex Pipe Line Co.--Plans 127 miles 20-in. along its route from Wink to El Paso.

Sinclair Pipe Line Co.--Building 300-mile line from Jacksboro, Tex., to Houston.

Products

El Paso Natural Gas--Plans 240 miles from Midkiff natural-gasoline plant in Permian basin to El Paso.

Magnolia Pipe Line--Plans 75-mile, 8-in. L.P.G. line from Hull to Texas City, Tex., and 30-mile, 8-in. from Andrews to Dollarhide, Tex. Plans L.P.G. line, 19 miles of 6-in., from Beaumont to Orange, Tex.

Phillips Chemical Co.--Plans 79 miles of 6 & 4-in. ethylene line from Sweeny to Pasadena, Tex.

Phillips Pipe Line--Let 64 miles of 12-in. from Sweeny, Tex. to Houston. Plans 135 miles of 12-in. looping between Borger and St. Louis.

Plantation Pipe Line--527 miles of 18-in. from Baton Rouge to Helena, Ala.

Tennessee Gas Trans. Corp.--Contracts let for 200 miles, 6-in. L.P.G. line from Banquete, Tex., to Houston.

Natural Gas

Coastal Transmission Corp.--Applied to FPC for 565 miles of 22-26-in. from McAllen, Tex., to Baton Rouge, to deliver to Houston Texas Gas & Oil Co.'s proposed line to Florida. Plans 272 miles of smaller gathering lines.

Lone Star Gas Co.--Plans before FPC to enlarge system: 230-mile line from Cotton Co., Okla., to Fritch, Tex., and 205-mile line from Snyder, Tex., to a hookup with the Cotton-Fritch line.

Natural Gas Pipeline Co.--Plans 350 miles of 20 & 26-in. from Jack and Wise Counties, Tex., to Fritch, Tex.

Texas Eastern Transmission--Applied to FPC for 422 miles of 30-in. from McAllen to Beaumont, Tex., to move imported Mexican gas.

TOTAL LEASES IN OFFSHORE AREAS

Company or Companies	Total Acres
Arkansas Fuel Oil Corp.	7,360
American Liberty Oil Co.	640
Atlantic Refining Co.	42,487
Atlantic-Tide Water	17,954
Atlantic et al	16,749
Brazos Oil & Gas Co.	2,214
Continental Oil Co.	3,360
Continental-Atlantic-Tide Water	5,760
Continental-Atlantic-Tide Water-Cities Service	39,459
El Paso Natural-Western Natural	20,180
Gulf Oil Corp.	18,560
Hamon, Jake L.	1,280
Highland Oil Co. (Assigned to Texas Gulf Sulphur Co.)	1,982
Humble Oil & Refining Co.	118,392
Hunt Interests	99,138
Kerr-McGee Oil Industries, Inc.	360
Magnolia Petroleum Co.	20,800
Magnolia et al	3,084
Mecom, John	1,254
Melben Oil Co.	11,360
Oil Drilling, Inc.	960
Ohio Oil Co.	4,903
Ohio-Melben	58,780
Phillips Petroleum Co.	6,880
Phillips-Kerr-McGee	12,960
Placid Oil Co.	3,178
Pure Oil Co.	6,400
Pure-Ohio-Melben	28,640
Pure-Ohio-Sun-Seaboard	84,327
Seaboard-Sun	17,651
Shell Oil Co.	17,721
Shell-Continental	103,680
Standard Oil Co. of Texas	17,193
Stanolind Oil & Gas Co.	59,177
Stanolind et al	2,855
Sun Oil Co.	19,622
Sun et al	4,480
Superior-Salt Dome	35,040
The Texas Co.	29,571